VOL. XIV. No. 8. AUGUST 1929

MECCANO MAGAZINE

HOW MOUNTAINS ARE MADE (See page 594)

6D.

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MECCANO MAGAZINE

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Vol. XIV. No. 8
August, 1929

With the Editor

The Holiday Month

The present month of August is the favourite holiday time of the year. Schools are closed, tens of thousands of workers in offices and factories take a holiday, and the majority of my readers at the present moment are enjoying the delights of fresh air and a change of surroundings in some seaside or country resort. Possibly some of them have gone even further afield, and may now be in Switzerland gazing at the stupendous bulk of the Matterhorn, shown on our cover this month.

Those who are able to take a holiday among the Swiss mountains are doubly fortunate. They not only have the advantage of spending a time in the pure atmosphere of one of the world's finest playgrounds, but also of undergoing a most interesting experience. The memory of the wonderful colour of the waters of the Swiss lakes and of the awe-inspiring majesty of the snow-covered mountain summits will remain with them for a very long time indeed. They will also realise the gigantic nature of the task undertaken by the daring engineers who have invaded the country and carried their railway lines across roaring torrents and through the very hearts of the mountains.

But wherever they may be, whether at home or abroad, I hope that all my readers will make the most of their opportunities. Now is the time to forget for a brief period the duties that occupy the greater part of the year. Even ordinary hobbies and pleasures should be thrown on one side in order that the benefits of a holiday in entirely new surroundings may be enjoyed to the full.

It is at this time of the year that I feel tempted to agree with a great French writer who said that life is like reading a book, and it makes very little difference whether we read chapter XVIII, which is on mathematics, or chapter XXXVIII, which is listening to the band playing in the gardens. I am afraid, however, that the world would make very little progress if everybody really did believe this statement. The true interpretation that we must place on it is that we should read both chapters, but we should be careful to give each its proper share of attention. There are definite times for work and for play, and they are really necessary to each other. "All work and no play makes Jack a dull boy," but all play and no work is even more disastrous.

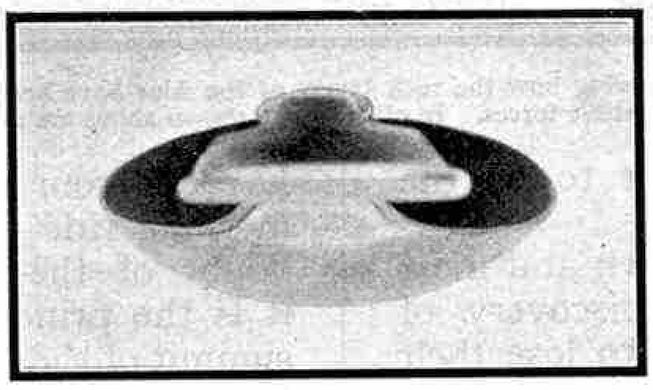
When Holidays Were Rare

I wonder how many of my readers know that holidays and recreation are comparatively new things. Until little more than one hundred years ago the hours of work were regulated by the Sun. This was particularly noticeable in the case in agriculture, work commencing with the dawn and ceasing after the Sun had set. In the reign of Henry VI this actually was settled by an Act of Parliament, which ordained that the labourer should be at work before five o'clock in the morning and should continue until seven o'clock at night in winter and eight o'clock in summer. As if this were not enough, it was enacted that any man who committed the crime of asking for more holidays was liable to imprisonment for a period of three months!

The journeymen and apprentices of the days of Queen Elizabeth were compelled to pass a similar joyless time. Apprentices were only allowed 2½ hours a day for recreation, and it is not surprising to learn that their masters often found it necessary to chain them to their benches.

I could give many similar instances of long hours of work with very little play. Thus in 1767 the Master Tailors humbly petitioned for longer working hours for their men—and these already worked 14 hours a day! At that time, and for many years later, a break of three weeks or a fortnight, or even a week, was quite unheard of. The only holidays were on Saint days, and naturally these were looked forward to with the greatest eagerness.

WHAT EVER IS IT?



No. 9. What is this mysterious looking object? An autographed copy of the Editor's book "Engineering for Boys" will be sent to the first reader who sends an exact answer to the question. Failing an accurate solution, the award will be made to the reader who gets nearest.

Solutions should be written on postcards only and addressed to "Editorial Competition No. 9, Meccano Limited, Old Swan, Liverpool." Closing date 31st August.

International Sports

On page 629 of this issue appears a photograph of the South African cricket team now touring this country. Its appearance reminds me of the peculiarly national character of cricket. Other games and sports are becoming international in character. Boxing and football for instance, once typically British, now fascinate the people of practically every European country, and also have spread to the Spanish-speaking nations of South America. But cricket remains intensely British, and the only countries in which it is played on a large scale are those populated by settlers of recent British descent, such as Australia, South Africa and New Zealand. In Canada and the United States, especially the latter, baseball holds exactly the same position as cricket and this game is as characteristic of North America as cricket is of Britain.

Boxing and football are not the only sports in which international rivalry on a large scale is experienced. Two that will come instantly to the minds of my readers are motor racing and aviation. For many years past the honours of the racing track have been fought out between cars of various nationalities, and the latest races to be decided—the Junior and Senior Grand Prix at Dublin—were won by Italian cars, which were closely followed home by cars of British make.

In the air the Atlantic flight supplies a notable example of this international rivalry. Aviators of various nationalities have set out to win the honour of being the first to make a clean flight from the old World to the New. Of these brave men it may be said that patriotism has been one of the motives.

Mystery Photograph No. 8

It was obvious from the stacks of postcards that greeted me on the morning following the publication of the July magazine, that the majority of my readers know exactly how a watch looks when laid on its back so that the chain ring is not visible

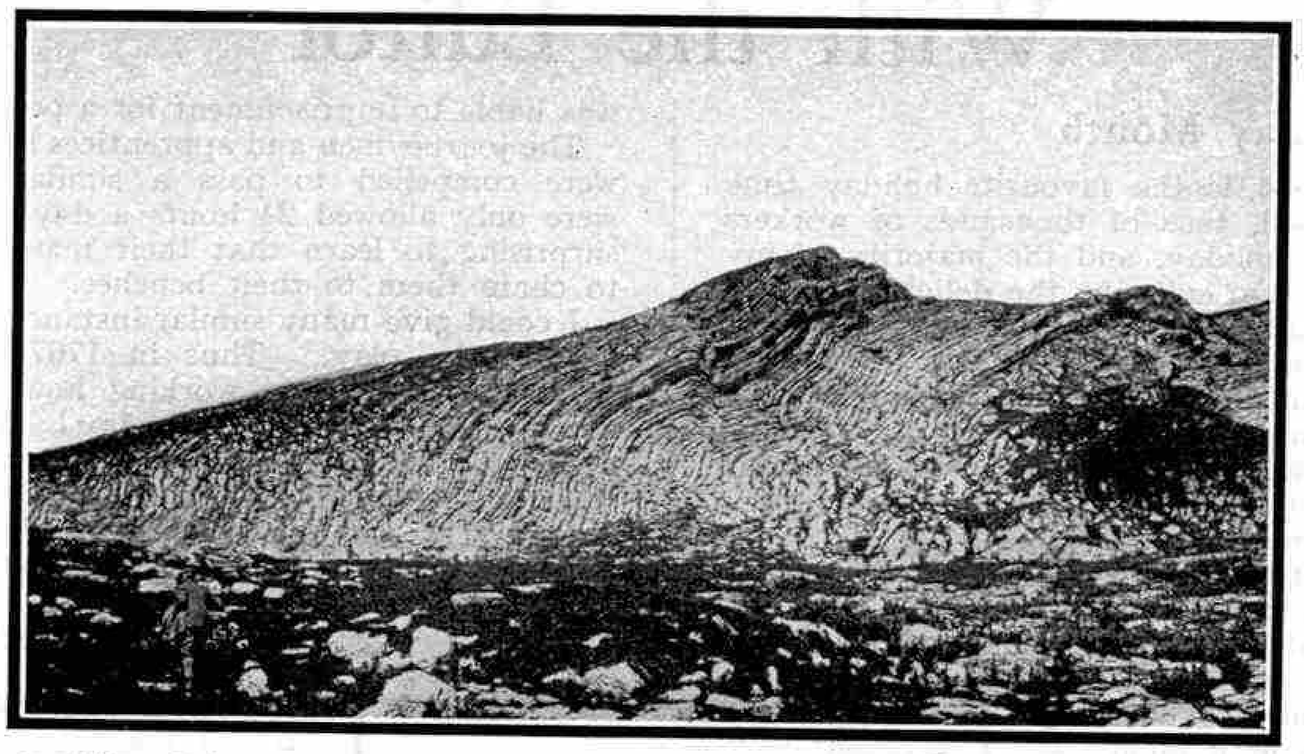
The number of entries for this contest easily constitutes a record, but the most amazing feature is that less than 20 competitors identified the photograph as something other than a watch!

The fortunate competitor, whose card among the thousands first caught my eye, is G. A. Storey, Highfield, Hartley Road, Altrincham.

How Mountain Ranges are Built

Rocks From Sea Floor Raised Four Miles

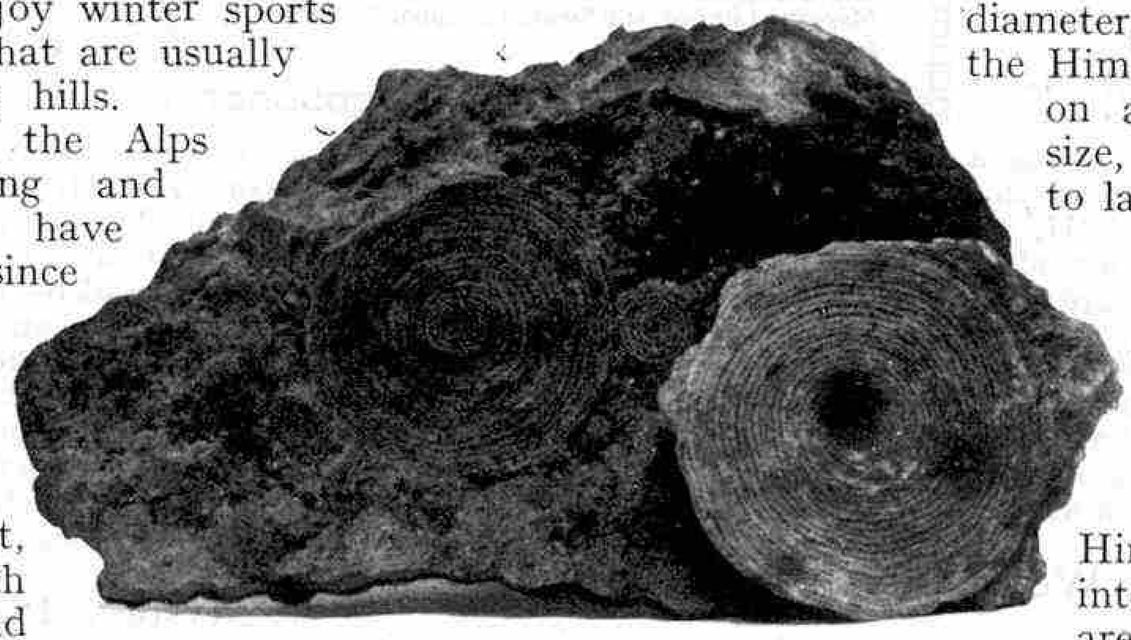
OUR cover this month shows one of the most famous of Swiss mountains, the Matterhorn. This magnificent crag rises to a height of 14,800 ft. above sea level, and a glance at its bold and noble proportions helps us to realise why our primitive ancestors regarded mountains with feelings of awe. They seldom attempted to climb them—mountain climbing even in the Alps is a modern sport—and imagined their summits, which were often hidden in the clouds, to be the homes of supernatural beings. The Greeks believed that their gods and goddesses inhabited the summit of Mount Olympus; the Cretans worshipped Mount Ida for similar reasons; while to this day the Himalayas are regarded with the greatest veneration by millions of Hindus, who believe the mighty range to be the guardian of their race.



A striking photograph showing how the rock layers of the Alps have been folded into fantastic shapes by irresistible forces. In places those shown above are now vertical

To most of us the Alps are the best known and most attractive of mountains, and even the discovery of much higher ranges has not caused them to lose their hold on popular imagination. They are so varied in character and so rich in wonderful scenery that they have become the playground of Europe. Every year thousands of tourists visit Switzerland and the Tyrol in order to revel in the exhilarating atmosphere of high altitudes, and to enjoy winter sports amid the snow and ice of what are usually described as the everlasting hills.

To the ordinary visitor the Alps certainly appear unchanging and records show that they have existed in their present form since the earliest days of history. When we examine them more closely, however, we begin to realise that the Alps are very far from being everlasting. They are, in fact, running down to the sea with surprising speed! Frost and water are the two great enemies that are ruthlessly wearing them down. Glaciers scour their sides, and the fragments brought down by them or broken away by the disintegrating effect of frost are carried away by rivers, and eventually reach the sea, where they are deposited in the form of mud and sediment.



A piece of limestone from the Alps. Although this was removed from the slopes of a mountain, the presence in it of fossils of marine shell fish shows that it was formed at the bottom of the sea

Even the immensely greater Himalayas and Andes are not exempt from this change and they also are being worn away. Every year 618 million tons of matter from the Andes are swept away down the channel of the Amazon River alone, and an even greater quantity must be carried by the waters of all the other rivers that have their sources in these mountains. So great is the annual loss that it has been calculated that the Andes will be worn away completely in nine million years!

At first glance this may seem an enormously long time, but in reality it is only a very small part of the 1,500 million years that probably have elapsed since the crust of the earth began to form. The mountains themselves, in fact, are very small affairs when we look at them from a proper standpoint. When gazing at Mt. Everest from the summit of Tiger Hill after an early morning ride from Darjeeling, a tourist has very little doubt of the immensity of the mountains of which it is the principal peak; and even to look up to the summit of the Matterhorn or Mont Blanc makes a human being feel very small. When we compare the height of these mountains with the size of the earth, however, we realise that they are mere wrinkles on its surface. The height of Mt. Everest itself is little more than one two-thousandth of the earth's diameter, and in order to represent the Himalayas in correct proportion on a globe of ordinary school size, it would only be necessary to lay down a short strip of the thickness of an ordinary playing card! From the point of view of size, the greatest of mountain ranges is thus after all a comparatively small thing.

The Alps and the Himalayas derive much of their interest from the fact that they are young mountains, for only a few million years have elapsed since they were raised to their present height! Frost and rain, the two great levellers of mountains, have had very little effect on them so far, but they cannot escape their doom. Many older ranges have existed, some of which probably were even higher than the Himalayas, but these have been worn down so far that now only the merest stumps

remain. For instance, the well-known hills of Killarney are remnants of great mountains of millions of years ago, from which thousands of feet of rock have been carried away by long vanished rivers to form sediments at the bottom of the sea. The fate that has overtaken the most ancient of mountains also awaits the mighty ranges that we know to-day.

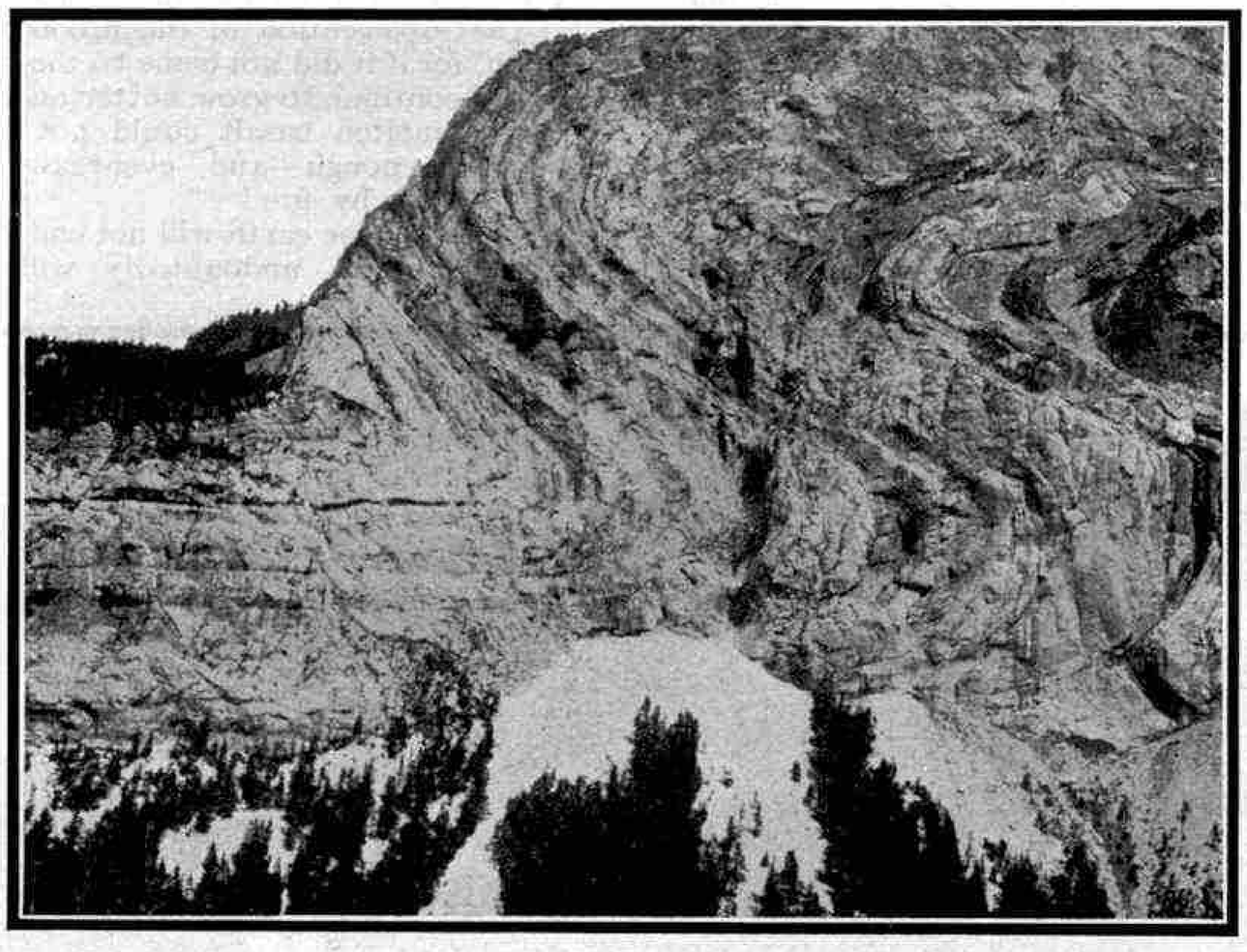
But that is not the end of the story. When the fragments reach the sea they are spread out over its bed, and through the ages deposits of enormous thickness have accumulated. There they are gradually consolidated by pressure into layers of rock, and mixed with them are the bones of fishes and the shells that once were the homes of tiny marine animals. Thus the rocks that have been formed in the sea are stamped with a mark that shows beyond doubt their place of origin. But to-day many thick layers of rock, marked in this manner to show beyond dispute their marine origin, have been discovered at the very tops of mountain ranges! In some mysterious way the material that has been removed from the ancient mountains by rain and rivers, and washed down into the sea, has been thrust up again into the open air, and possibly to a greater height than that at which it previously existed.

In the Alps, rocks containing marine fossils have been found at a height of 10,000 ft. above sea level, and in the Himalayas similar discoveries have been made 9,000 ft. higher. Both mountain ranges contain beds of limestone that are largely composed of disc-shaped spiral shells. Sometimes these are slightly larger than a florin, and from their shape they have been called coin-fossils. When the animals that originally inhabited the shells died, their bones were buried in the limy sediments at the bottom of the sea, and millions of years later were thrust upward, in some places to a height of 19,000 ft.! The limestone in which they occur is slowly but surely being disintegrated by snow, ice and rain, and is once more journeying down to the ocean, possibly in some far distant era to become part of still another gigantic range of mountains.

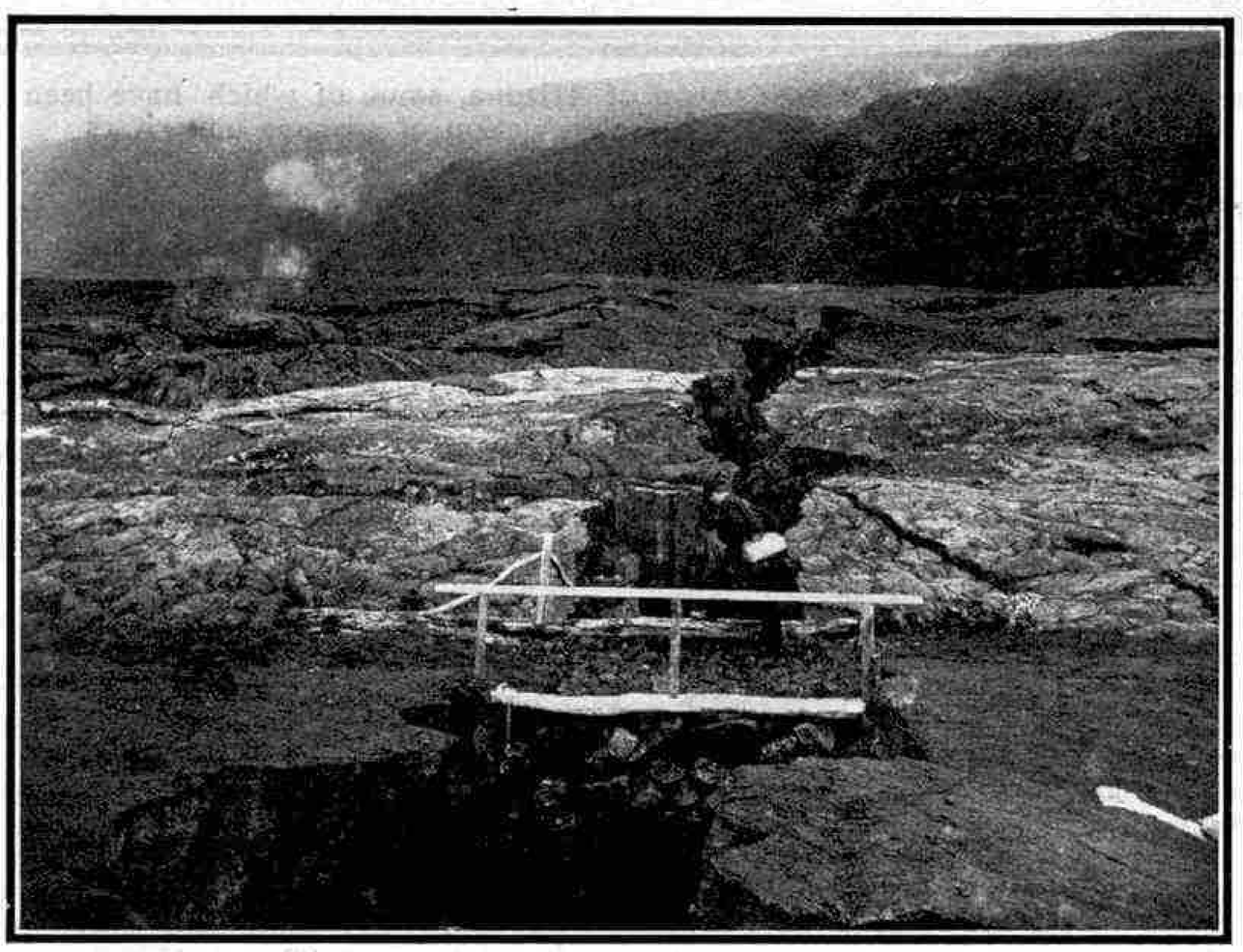
It is a curious fact that the pyramids of Egypt are built of this very limestone, which is found on both shores of the Mediterranean Sea and stretches from the Alps and the Apennines into the heart of Asia. The Pyramids have endured for so many thousands of years that they are popularly supposed to be of hoary antiquity but, like the still older mountains that yielded the stone of which they are built, they are slowly being worn away, and some day the material composing them may be at the bottom of the sea, thus returning to the place from which it started millions of years ago.

When laid down at the bottom of the sea the layers of rock that now form part of the mountains were undoubtedly level, but in their present homes they show curves and twists of astonishing complexity, showing that during the passage from one position to the other they have been pressed sideways. This folding of the regular layers of rocks that make up mountain ranges may be closely imitated by squeezing layers of stiff clay by side forces. In one interesting series of experiments the successive layers of clay were plastered on pieces of stretched india-rubber. When the base was allowed to contract slowly to its ordinary length, the folding that took place was astonishingly like that shown by the rock layers of the Alps.

After all, then, it seems that the hills may be regarded as everlasting—but they change their situation! The material of which they are built spends the intermediate intervals at lower levels, chiefly at the bottom of the sea. The changes from mountain range to sea floor and back again are continuous. At the present time mountains are being worn down, and there are no signs of any being formed, except in a few isolated instances of volcanic action. In past ages, however, there have been periods when



Another photograph of the fantastically folded and contorted rock strata that may be seen in the Alps. For this and the photographs on the opposite page we are indebted to the courtesy of Professor P. G. H. Boswell, O.B.E., D.Sc., F.G.S., Department of Geology, University of Liverpool



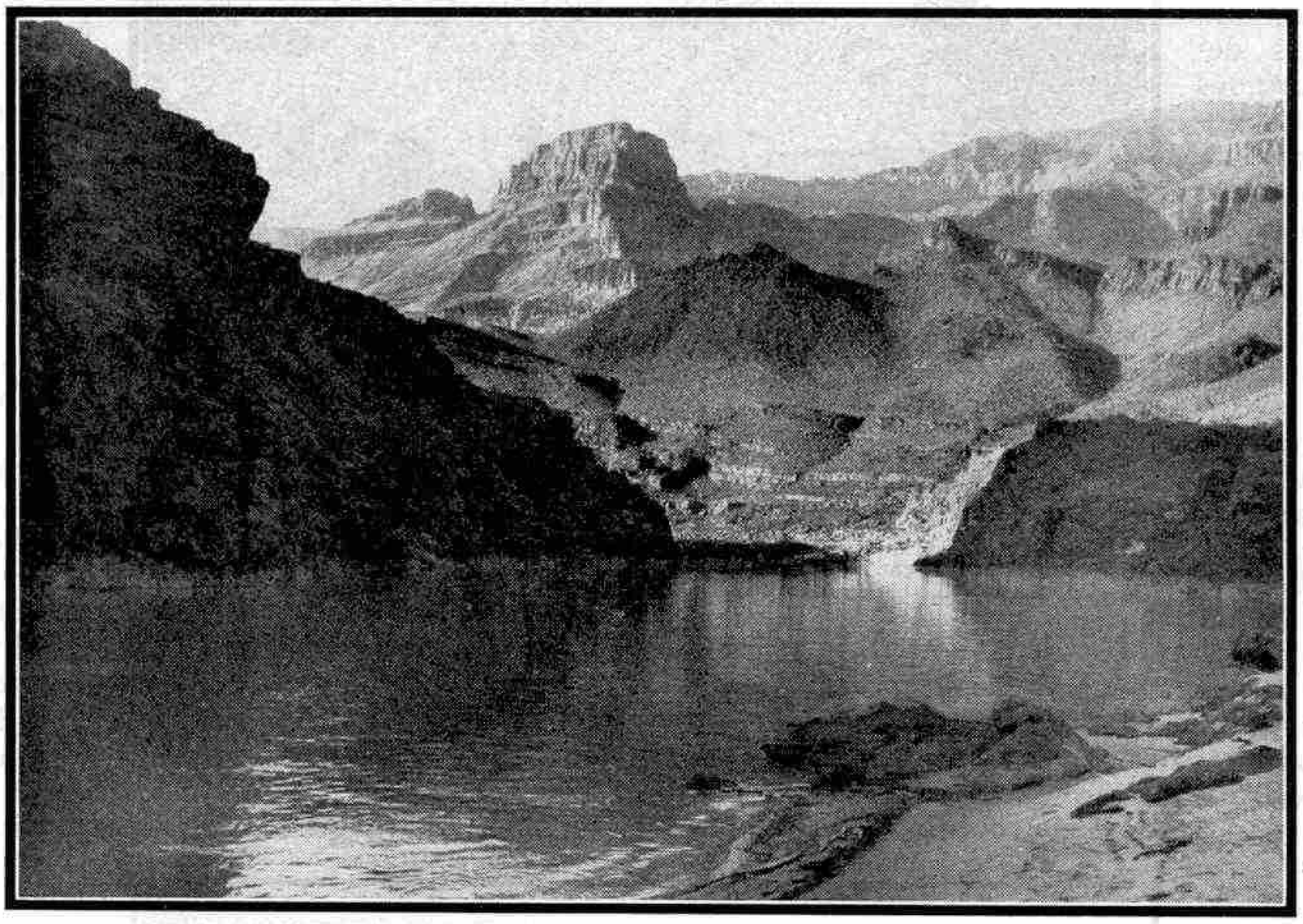
Lava that has solidified after welling up through fissures in the great crater of Kilauea, the famous volcano in Hawaii. Similar outpourings on a gigantic scale have accompanied past outbreaks of mountain building activity

they were being thrust upward more quickly than they were being destroyed. At some time in the future the position again may be reversed, and new mountain ranges rivalling the Alps and the Himalayas in height and grandeur will then arise.

When we think about the wonderful changes in which mountains are involved it is easy to realise how the material forming the ranges finds its way to the bottom of the sea, but how it is thrust up into the skies once more has long been a puzzle. The only certainty is that the forces concerned must have been terrific, for in cases many millions of tons of rocks have been lifted through a height of several miles.

A reasonable explanation has now been suggested, and it makes a very wonderful story. It seems that certain parts of the interior of the earth are more radio-active than the surface layers. Therefore they and the earth are continually growing hotter, one of the chief characteristics of radio-active substances being that they radiate heat produced by wonderful changes within the atoms of which they are composed. This is a great surprise, for it has always been supposed that the earth is slowly cooling, and that it is steadily approaching a time when everything on it will be frozen and life will be extinct. This may be its ultimate fate, but apparently in the meantime there may be periods in which our planet will renew its youth.

It may come about that Great Britain, and perhaps even Iceland and Greenland, will once again be tropical countries in which giant palms and strange plants of all kinds will grow freely and luxuriantly. At one time these countries did enjoy a warm climate, and the remains of the forests that covered them exist in the form of the coal that is mined in Great Britain, and which exists in Spitsbergen and other arctic islands that are now covered with snow. At the present time we are using our coal supplies so rapidly that they will be exhausted in a few hundred years; but apparently the inhabitants of the earth millions of years hence may find coal formed from trees that are not yet in existence.



The water-worn gorges of the Grand Canyon of Arizona, some of which have been eroded to a depth of 6,000 ft. by the ceaseless action of streams and rivers

The portion of the earth that is supposed to be growing hotter is composed of heavy rocks called basalts. It forms a layer that lies between the outer crust, consisting chiefly of the lighter rocks that form the continents, and the hard centre or core, which is supposed to be largely composed of iron and nickel. The radio-active heat there generated cannot easily escape, for the rocks above are poor conductors of heat; and it is believed that eventually this layer may reach such a high temperature that it will melt into a thick viscous liquid.

When the intermediate layer of basalt melts in this manner, the outer crust must necessarily float on it instead of forming a fixed and solid portion of the earth! This sounds very fantastic, and even alarming, but the people now living on the earth need have no fear of disastrous collisions between floating continents or of islands sinking during storms on the hot seas of basalt on which they will then float. Millions of years separate us from the time when the temperature of the basalt will become sufficiently high to bring these strange changes into operation. Even when the continents do get afloat there will be no disasters, for the entire crust or outer layer of the earth will float as one mass, and this includes the rocks on the floors of the oceans that connect the continents together.

When the crust is floating on the molten basalt the earth will be at its hottest, and then the moon will interfere to make things cooler. The earth is, of course, a spinning ball careering through space, but when the crust is separated from the core of the earth by the liquid on which it floats, the pull of the moon on it will act as a brake, and it will lag behind the spinning centre. Thus the hot liquid will lie between the rapidly spinning centre and the slower-moving crust. It will be thoroughly whipped and stirred up, and in addition each portion of it will be brought into contact with the thin part of the crust that forms the sea floor, and through this heat will escape into outer space.

The intervention of the moon will be very fortunate for the earth, for if it did not come to the rescue in this manner our planet would continue to grow hotter and hotter—for the heat generated in the molten basalt could not escape through the continents quickly enough—and eventually would be threatened with destruction by fire!

Although the earth will not end in a gigantic blaze, catastrophes of some kind undoubtedly will occur. There will certainly be frightful earthquakes, for the continents will creak and bend when their normal solid support is removed. Destructive floods also will be experienced, for some parts of the continents will settle so far down into the molten basalt that the oceans will rush over huge areas of land at low levels.

But there will be even more spectacular disasters in the form of volcanic eruptions on such a magnificent scale that they may be visible to dwellers in other worlds, and if, in that distant period, Mars is inhabited, we may imagine the people on that planet peering at the earth through their giant telescopes and suggesting fanciful explanations for the sudden appearance of huge red spots on its surface!

The red hot lava will not pour out through mere volcanoes but through great rifts opened in weak portions of the earth's crust by the pressure of the liquid basalt. This has happened on previous occasions in the history of the earth. In Western India, for instance, there is an amazing mass of volcanic rock that covers an area of more than half a million square miles. Such an outpouring of lava cannot have been due to volcanoes of ordinary size, for if all the red-hot liquid that now pours down the sides of every volcano in the world were brought together into one stream, this would be quite incapable of covering such a large area to any depth.

Under the taming influence of the moon these frightful convulsions will become less frequent, and our planet will then begin to cool. Interesting events will follow, for it is during this cooling period that mountain building begins. In the same manner as other cooling bodies, the earth will contract. Its crust must then accommodate itself to the shorter circumference, and this it can do only by crumpling somewhere, just as the skin of an apple wrinkles when the fruit dries up.

Where will this crumpling take place? The continents themselves are not likely to collapse very readily, as their thickness varies between 22 and 37 miles. The beds of the ocean are also scarcely likely to give way; they are the radiators of the earth and are stiff owing to their water cooling. A weaker place than either of these is to be found on the borders of the oceans, where the thick layers of sediment brought down from ancient mountains by rivers will have been accumulating for ages. These will still be comparatively soft, and unable to offer great resistance to the horizontal pressure due to the contraction of the crust; and it is there, between the continents and the oceans, that the crushing and folding will take place.

(*Continued on page 629*)

Beetles That Devour Books & Timber

The "Death Watch" Superstition

By Capt. E. A. Humphery Fenn

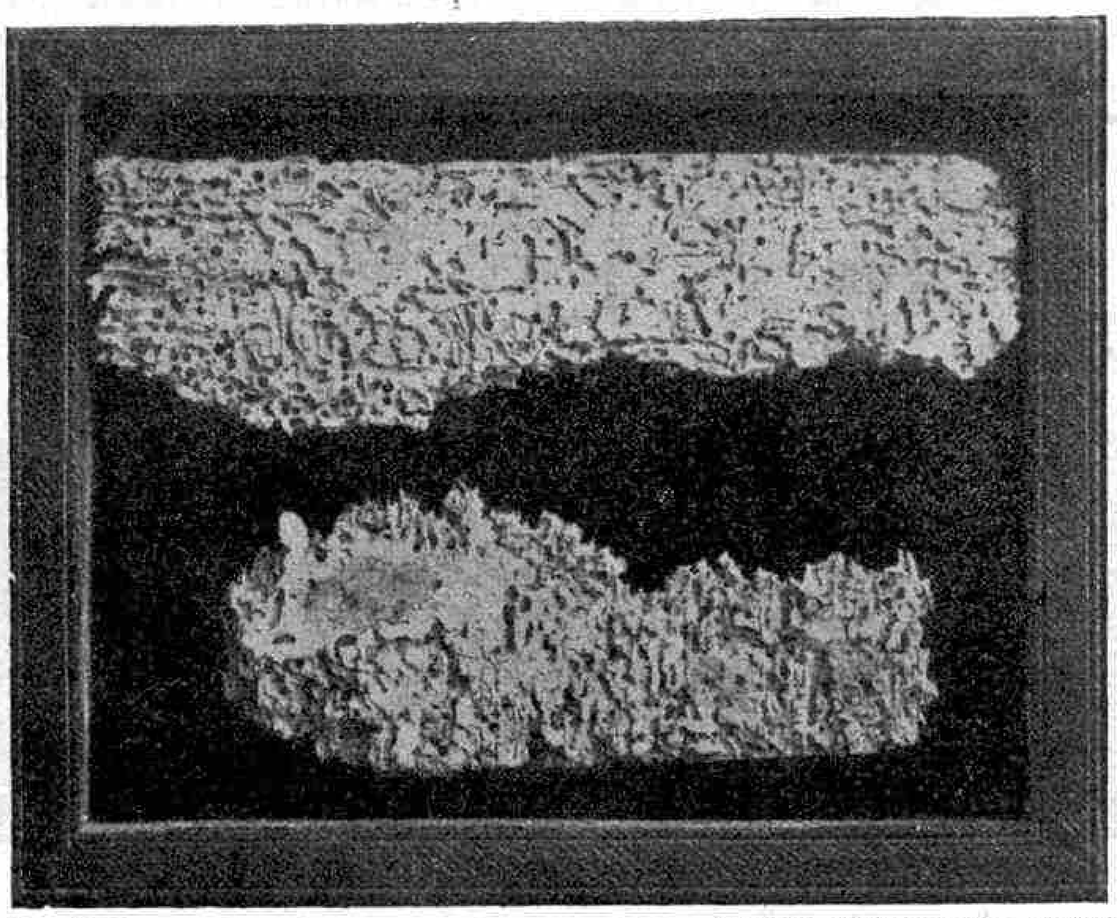
THE majority of people, if asked to define the meaning of "bookworm," would say that it is the name given to an individual who is exceedingly studious and devoted to learning and who cares very little for games or other outdoor pursuits. This is certainly one definition of the word, but there exists also an actual bookworm. The name is misleading, for the creature referred to is not a worm at all, but a minute species of beetle. The word "worm" has become generally accepted, however, and books or furniture are said to be "worm-eaten" when they are riddled by the tiny holes bored by this destructive beetle.

It is curious that there are several other instances in which the word worm has been universally applied to creatures that are not worms—the silkworm, which is a caterpillar; the glow-worm, which is a beetle; the wire-worm, the larva of a beetle; the slow-worm or blindworm, a species of lizard, etc.

It is very characteristic of small creatures of the insect world to have names much longer than themselves and this is the case with the bookworm, which rejoices in the name of *Anobium striatum domesticum!*

The bookworm is merely one member of a whole family of beetles whose tastes, unfortunately, lie in undesirable directions. One can admire a healthy appetite, but not when it results in the wholesale destruction of books and timber! The bookworm appears ready to consume anything that is not armour-plated. It devours the bindings and pages of books and it attacks wood with special avidity, as is shown by the multitude of tiny holes with which old beams and furniture are often found to be riddled. If undisturbed the beetles will, in time, eat away a whole wooden structure, leaving behind only a shell that crumbles to dust when touched.

The most interesting feature of this small pest is the strange ticking noise that the female makes with her mandibles when calling to her mate. The sound is most easily heard at dead of night when all is still and it then arouses an eerie sensation in the listener. Until comparatively recently the cause of this sound was not generally understood, and it is not surprising that the ticking became known as the "death watch," a name that probably will cling to it for many a long day. The most favourable place for hearing the "death watch" is in an old house in which the beams and other timber have not been restored in any way. Such timber often forms the home of countless numbers of these beetles and their nightly ticking is certainly uncanny.

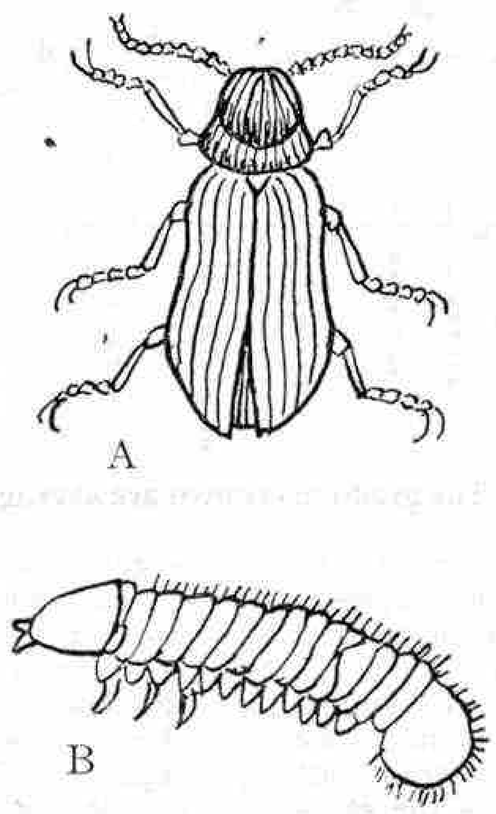


Courtesy] [Messrs. Maltby & Son, Oxford

Portion of Worm-eaten Wooden Board from the Binding of an old M.S. found in Hereford Cathedral Library

The same sound may be heard issuing from old books that are being steadily consumed by the bookworm. In this case, however, the sound is not so loud because the beetles' mandibles are striking on substances of a softer nature, such as skin, leather or paper. Books attacked by these insects may be completely destroyed unless the mischief is discovered and remedied at an early stage.

There is no doubt that the ticking sound is produced by the striking of the female beetle's mandibles upon wood or other material, for the body of the creature itself is too soft in composition to produce a sound of this nature. There is a possibility that the grub also may produce the noise, for it actually has stronger mandibles than the perfect insect.



A

B

The "Death Watch" Beetle: A, Perfect Insect; B, Larva (drawings greatly enlarged)

The bookworm has been made the subject of special study on account of its peculiar habits. One naturalist kept two of these creatures in a box for a period of about three weeks, during which time he found that by imitating their calls he could make them "tick" whenever he wished! At the end of this period one insect died and the other, apparently feeling lonely, gnawed its way out.

Very many other instances might be given of the destructive work of the "death watch." Fortunately means have been discovered of checking its ravages. Wood that is being attacked is sprayed with a liquid containing dichlorbenzene and barium oleate, two chemicals that have a deadly effect upon the beetle. The first of these vaporises and penetrates the tunnels to kill the grubs that have made them. The second forms a thin film on the surface, through which any grub that escapes the dichlorbenzene must eat its way out when it has become a beetle.

An Interesting Run on the S.A.R.

Over the Lootsberg Pass

By D. Arnold-Forster

TRAVELLING by train is nowhere more fascinating than in the Union of South Africa, but the interest is of a different kind from that generally associated with railway travel in this country. No thrill is to be found from high-speed running on South African railways, and as trains are few and far between there is no special interest in the methods of signalling or regulating traffic. The fascination lies rather in the feeling of boundless space as the train, plodding along hour after hour, day after day, struggles over rugged mountain passes, winds among hills and kopjes, crosses hundreds of miles of flat bush or veldt, or rumbles noisily over bridges spanning famous rivers.

Among the best-known through runs in South Africa are the 1,362-mile journey to the north, from Capetown to Buluwayo in Southern Rhodesia, occupying 64 hours, and the 1,265-mile run from Capetown via Bloemfontein to Durban on the east coast, which takes 48 hours. There is also the journey by the famous Capetown, Johannesburg and Pretoria express, which covers the 956 miles to Johannesburg in about 36 hours; and the shorter but extremely interesting 482-mile run from the 6,000 ft. altitude of Johannesburg down through Natal to Durban. On these journeys by famous and luxurious trains of 15 coaches or so, every minute of one's waking hours is full of interest of some kind, whether it be in the appearance of the country itself, the wonderful engineering feats in the construction of the line, or the technical details and working of the train.

There are also on South African railways other runs by less famous trains that pass regularly over country at least as difficult as any of those just mentioned. One of the most remarkable is the journey over the Lootsberg Pass in the Cape Province, on a branch line known as the Graaff Reinet Loop. This 99-mile stretch of line connects Rosemead, an important railway junction, with the pretty old Dutch town of Graaff Reinet, almost due south of it.

Graaff Reinet lies near the northern edge of the arid 2,000-ft. plateau called the Great Karroo, while Rosemead is near the southern edge of the vast rolling 4,000-ft. plateau of the veldt which, stretching away toward the north, forms one of the steps up to the 5,000-ft. level of the Orange Free State, and the still higher 6,000-ft. level of the Transvaal. The two towns are separated from one another by the Sneeuwberg range of mountains, across which cuts the Lootsberg Pass. The highest point on this Pass is 6,000 ft. above sea level.

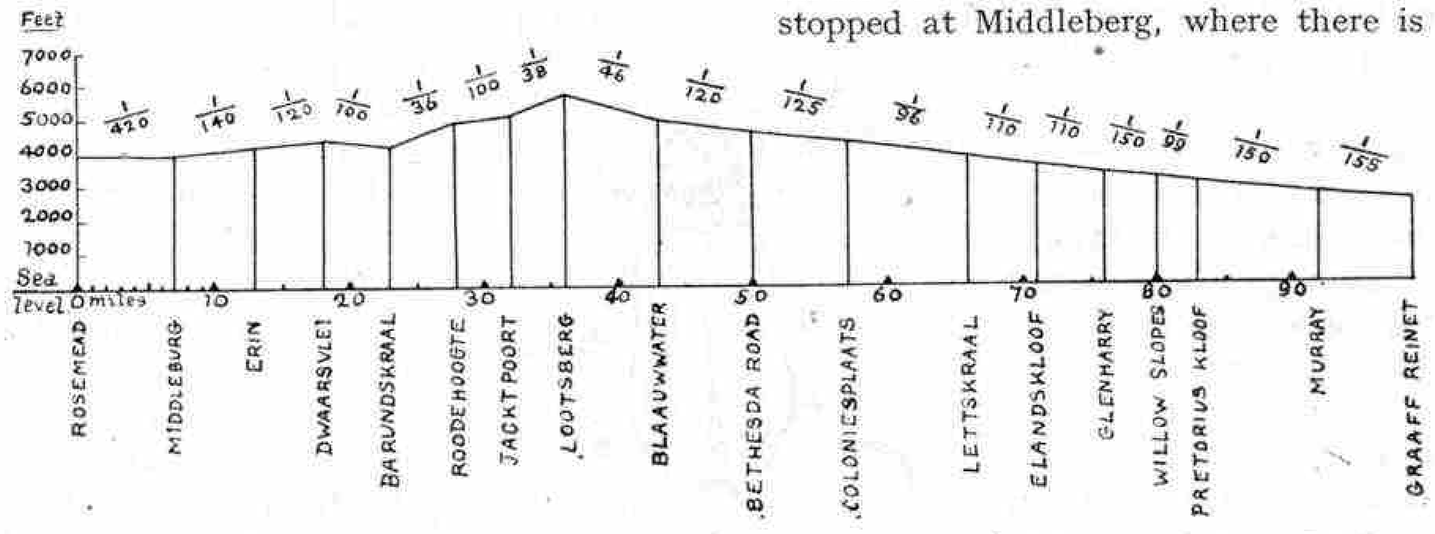
Early one morning, being bound for Graaff Reinet, I alighted at Rosemead Junction from the Johannesburg—Port Elizabeth main line night express. The Sun was only just up, and at that altitude of 4,000 ft., though nearly mid-summer, there was a fresh nip in the air, and I was glad to get a cup of coffee on the station platform. I then watched the leisurely marshalling of the mixed train for Graaff Reinet, an operation that involved much sorting out, re-shuffling and shunting, and which kept two engines and most of the station staff occupied for nearly an hour. Eventually the train was made up as follows—an eight-coupled engine, a water tank, two small trucks, three long bogie trucks piled up with coal, a six-coupled engine, two small trucks, two covered vans and five coaches.



Kendrew Station on the Great Karroo

New rolling stock is not wasted on these branch lines. The only modern vehicles included in this curiously assorted train were the long bogie trucks, each with a carrying capacity of over 40 tons, the sight of which made me feel rather ashamed of the little old-fashioned coal trucks at home. Though the South African standard gauge is only 3 ft. 6 in., most of the rolling stock is built with so much overhang that a train standing in the station looks as wide as any with which we are familiar in England.

The two black engines had a big head of steam, and their tenders, heightened by guard rails, were piled high with coal. At 8.10 a.m., the few passengers having found their seats, the engines whistled in succession and with a tremendous jerk the train started on its 36-mile climb. After a 7-mile run up an easy gradient it stopped at Middleberg, where there is a big agricultural college with over 20,000 acres of land. The straight wide streets of this prosperous little country town are shaded by long avenues of eucalyptus trees. Lying snugly at the foot of the mountain, the town is fortunate in having a good water supply, and although the high veldt stretching for some 400 miles to the north was parched and dry from lack of rain, vegetation all around here looked fresh and green.



Elevation of Graaff Reinet. The gradients shown are average between stations and sidings

After Middleberg the line entered the foot of the valley leading up to the Lootsberg Pass, and for the next 11 miles there was a steady pull up, the gradient posts showing about 1 in 120. Though this part of the climb is not so very steep, the line winds about through rocky gorges in such an extraordinary manner that both engines had to work hard as the train twisted round the sharp curves. From the observation platform at the end of my coach I soon got to know the look of both engines and their crews well. At one boulder-strewn point the leading engine, which I had been watching, disappeared behind some rocks, and appeared again a little later well away to the left, as though it had nothing to do with us! In the meantine the other engine in the centre of the train curved sharply to the right and disappeared from view!

We stopped at a small siding to drop a truck and to pick up

another water tank. This water question was important, as the country was suffering from drought. The engines get through a lot of water on this kind of work, and an adequate supply had to be arranged for them, as well as for the staffs at little wayside stations and sidings along the line.

After an easy run down for the next five miles we arrived at the foot of the steepest bit of the Pass. Here a dining car with its attendants was waiting all by itself on a lonely siding, and we stopped for some time to hitch it on and to re-shuffle the train for the steep pull ahead. The leading engine, with a small truck and water tank still behind it, dropped to the rear of the train to shove. We now had the long bogie trucks leading, followed by the six-coupled engine and the rest of the mixed train.

The climb now began in earnest. Gradient posts showed 1 in 40 and 1 in 30, and there were occasional sharp curves. It was now 10 o'clock and the hot African sun was well up. There was a clear blue sky, with a few delicate white clouds floating in it, and not a breath of wind. On my observation platform it was extraordinarily quiet and peaceful, the only sounds being the slow heavy puffing of the two engines, which shot columns of black smoke straight up into the air, and the leisurely click of the coach wheels over the rail joints as the train crawled along at walking pace. There had been a little rain on that side of the mountain, and the sandy-looking surface of the narrow valley up which we were laboriously climbing was covered with long green grass. The yellowish-red colour of the soil was shown up clearly by innumerable great ant heaps.

Calculation of train weights enters very largely into traffic management on South African railways. Important main line trains are of course given powerful modern engines, with a big Garratt articulated engine when necessary to help them up steep banks, ensuring a good margin of power. For our train the weights must have been worked out to a nicety. Both our leaky old engines were "all out," and one felt that the addition of even one more coach would have brought them up "all standing." Whenever there was a glimpse of the firemen they appeared to be shovelling on coal—little and often. For some time I watched the driver of the rear engine standing on the coal of his tender, smoking a cigarette and admiring the view. The throttle was wide open and I suppose he felt that there was nothing more for him to do, and that it was up to his mate to keep her moving.

I had often noticed smoke without steam coming from the chimneys of the locomotives in South Africa, and had thought they might have some kind of condenser to save water. At one of the stops on the journey I got out and asked one of the friendly Dutch drivers about it.

"Lots of steam comes out of the funnel, mister," he explained. "Early mornings you can see it all white. In daytime you cannot see it because it goes quickly into the air."

The fact is that on most days in that dry climate, and especially at the higher altitudes, the evaporation due to the Sun's rays is so rapid that the steam vapour from the chimney does not condense into the familiar long white ribbon of cloud, but remains as invisible as when it issues from the exhaust.

After five miles of this slow progress the gradient eased to about 1 in 100, and for the next four miles our speed increased. Toward the top of the Pass the valley widened out, showing a broad expanse of grass bounded by mountain ridges on each side. There were no trees, except for small clumps planted round the isolated little homesteads scattered here and there. Several herds of horses and many groups of black and dun coloured cattle were grazing in this high mountain valley.

For the last four miles of the climb the gradient became as steep as ever and the speed dropped down again to walking pace. Occasionally the sound changed as we passed over a steel bridge crossing a deep rocky donga, at the bottom of which there were still signs of the recent rain. Near the top a woman came out of a picturesque little house near the line and handed up a parcel to the cab of the leading engine. She then walked alongside the moving engine for a mile or so, talking volubly and joking with the driver and his mate!

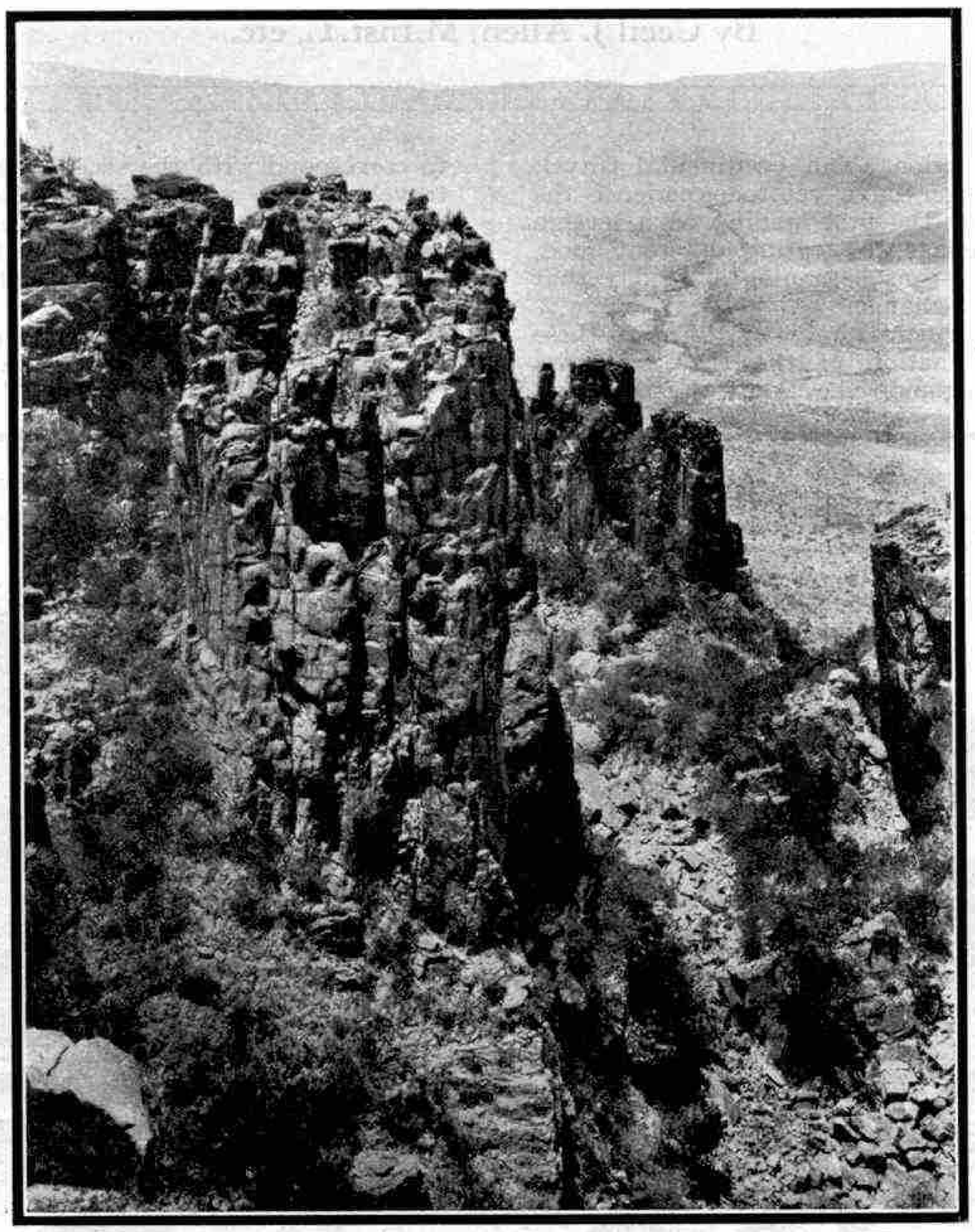
When the summit was reached, the heavy puffing suddenly ceased, the couplings eased up, and the rattle of the wheels became louder as the speed increased. Away to the south and far below us the view of a wide expanse of flat country opened up, bounded in the clear distance by the outlines of blue mountains. Looking back I saw that the rear engine had disappeared.

Though our speed had increased considerably, it was still slow and steady for the first seven miles of the descent. The brake blocks ground on the wheels, and there were no signs of letting her go. There was a drop of 800 ft. in this section, with gradients of between 1 in 40 and 1 in 50. From the observation platform the train looked like a monster snake crawling slowly down the mountain side, the silent engine, with the bogie coal trucks ahead of it, using its steam brakes and leading cautiously round the sharp corners.

The construction of the steep sections on each side of the summit of this Pass is as great a feat of engineering skill as anything to be seen on the more famous Hex River Pass. I was told that at some points the men excavating the road had to be slung on platforms from the vertical rock face. The diagram shows graphically the altitudes on the line, and the average gradient between each small station or siding. Some of the actual gradients were of course rather steeper. The queer jumble of Dutch and English names of the stations and sidings is typical of the country, and the confusion is sometimes increased by the use of native names in English or Dutch disguises.

For the last 56 miles to Graaff Reinet the line drops all the way at varying gradients for another 2,500 ft., the last part following the winding gorges and valley of the upper waters of the Sunday River, which flows through Graaff Reinet before crossing the Great Karroo on its way to the south coast. On this side of the Pass there was no grass and the small bush of the Karroo replaced it. Sheep became more common, and also ostriches. As the lower valleys were reached we passed close by many irrigated farms, some of them very large and prosperous, judging by the great herds of well-bred Frisian cattle to be seen on them.

We reached Graaff Reinet at 3.20 p.m., and here the train was re-organised for the night run across the Karroo to Klipplaat Junction and Port Elizabeth. The total time taken for the 99 miles from Rosemead was 7 hours 10 minutes. The average speed of the train, including stops, worked out at 10.8 miles per hour for the pull up to Lootsberg, and 16.4 miles per hour for the run down from there to Graaff Reinet. These speeds are not very great but the magnificent scenery and the engineering features of the line make the day's run as interesting as any to be found in South Africa.



Photograph courtesy] [*South African Railways and Harbours*

The Valley of Desolation on the Graaff Reinet

FAMOUS TRAINS: XXXI.

The "*Newhaven Boat Express*"

Southern Railway

By Cecil J. Allen, M.Inst.T., etc.

THERE is a tremendous attraction about Continental travel. Most of you who are younger have yet to experience the real thrill brought about by the first landing on a foreign shore, by hearing another language, by eating different food, by seeing strange sights, and by thus beginning a holiday that is, in every sense of the word, a "change."

The Southern Railway is the principal gateway for us to these lands of enchantment. Amalgamation of the three railways serving the South Coast of England—the South Eastern and Chatham, the London, Brighton and South Coast, and the London and South Western—has given the Southern management the command of no less than eight Continental routes. These are Dover to Calais; Folkestone to Boulogne; Newhaven to Dieppe; Southampton to Havre and (in summer) to St. Malo and Caen in France; Dover to Ostend in Belgium and Gravesend to Rotterdam in Holland. Most of the passenger traffic to France and Central and Southern Europe generally goes by the Dover-Calais and Folkestone-Boulogne routes, because they are the quickest; but in the summertime, in particular, the Newhaven-Dieppe route comes into great favour, because it is a considerably cheaper route to Paris, even though it may take a little longer to cover.



Courtesy [*Southern Railway*

The maze of electrified track at Victoria Station. This station is one of the largest in London, with a total of 17 platforms and an area of 23 acres. It combines the old South Eastern and Chatham terminus on the right-hand side, with the London, Brighton and South Coast station on the left-hand side

Newhaven, the nearest of all cross-channel ports to London, Tilbury alone excepted, was developed by the late London, Brighton and South Coast Railway, in conjunction with the Western section of the State lines of France, who established their port at Dieppe on the French coast. Between the two the fast turbine steamers employed on this service, some the property of the Southern Railway and the others of the French "Etat," make the journey across in a little over three hours. Including the port formalities, the day journey from London to Paris by this route is eight hours, or about one hour more than the "Short Sea Routes." There is a day service and a night service, the boat trains leaving Victoria at 10 o'clock in the morning and 8.20 in the evening. It is, of course, the day service that is the more popular of the two, and at times of particular holiday pressure the day train between Victoria and Newhaven has been known to load up to as much as 500 tons—a tremendous figure for the Brighton section, or any other section of the Southern for that matter.

One reason for this weight is that, as with all the Continental trains now, the Southern authorities use on this service their latest and most comfortable type corridor coaches, each weighing 32 or 33 tons, in conjunction with a 12-wheeled Pullman car, so that a 12-coach formation alone brings the weight above the 400-ton mark. The second-class coaches—second-class is still employed on this service, as on the L.N.E.R. Continental trains, to correspond with the second-class that is the chief medium of travel abroad—are usually marshalled on one side of the Pullman car and the first-class coaches on the other. The whole train is vestibuled, and meals and light refreshments are served by the Pullman attendants throughout its length. One or two vans complete the formation.

The working of the "*Newhaven Boat Express*," whether by day or night, is generally entrusted to the fine "Atlantic" engines of the late Brighton Company. There are two distinct series of these locomotives; the first, turned out in 1906, consisting of five engines—Nos. 37–41—and the second of six—Nos. 421–426. This makes the curious total of 11 in all. It was Mr. Earle Marsh who brought the design to Brighton from Doncaster, and the first series, save for having rather larger cylinders, were almost exact replicas of the famous Ivatt "Atlantics" of the late G.N.R.

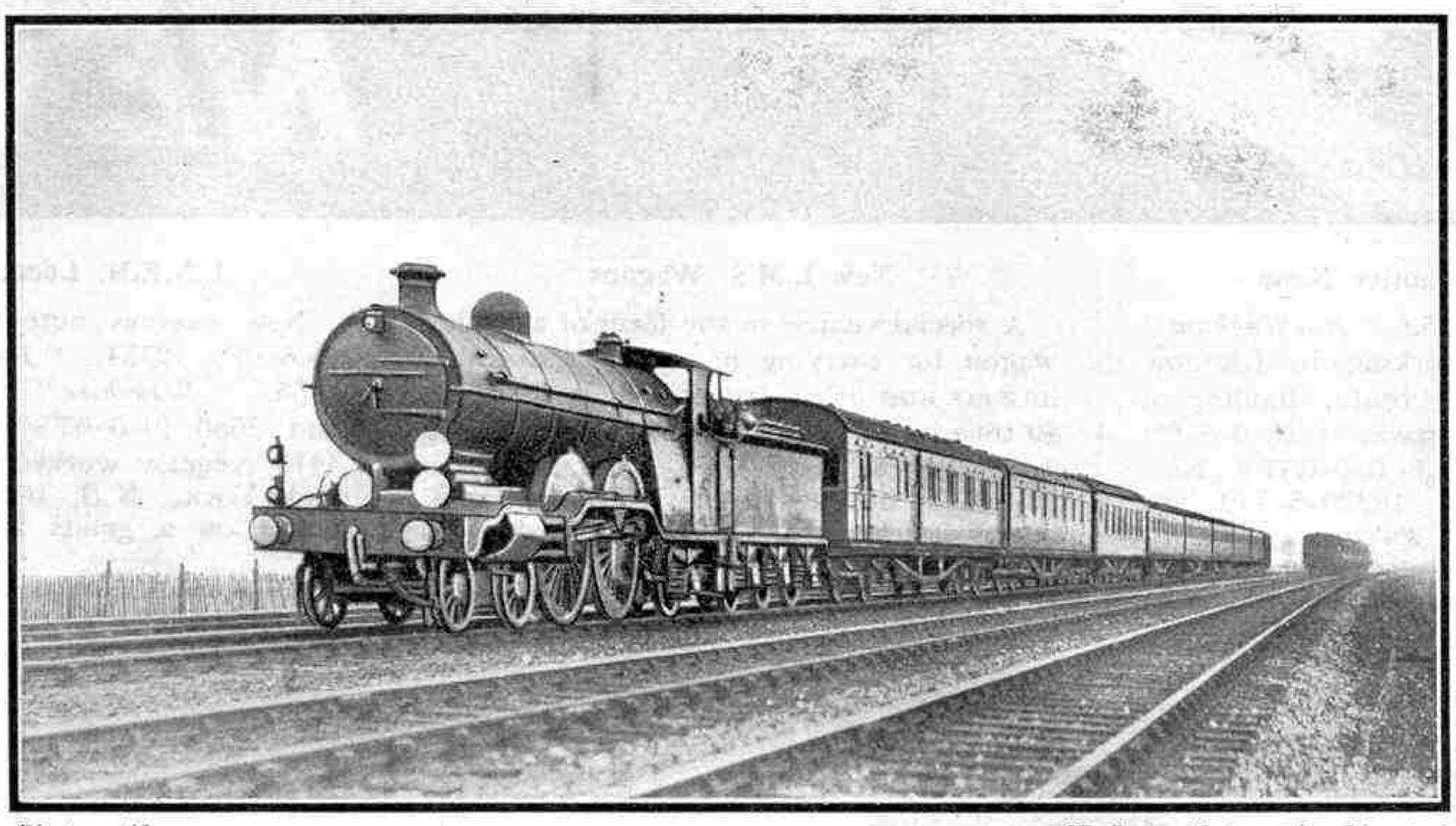
In the second series the cylinders were further enlarged, to the big figure, at that time, of 21 in. diameter by 26 in. stroke; and superheating equipment was provided. Since then the earlier engines also have been superheated, and the 11 have received the names of well-known headlands on the coast served by the Southern Railway. So it is quite possible that we may find a locomotive at the head of our train bearing a name like "*Portland Bill*," or something equally singular; but we shall see that "*Bill*," whether from Portland or any other locality, is quite equal to the "hard labour" that may be set him to do, and at the same time clearly devoid of any criminal proclivities!

Work over the Brighton main line of the Southern *is* hard work! Out of the terminus at Victoria the line rises straightaway on a gradient which, though short, is as steep as 1 in 64, until the Thames has been crossed by the Grosvenor Bridge. From the South-Eastern side of the station the inclination is still steeper, being at 1 in 61. In this case outgoing main line trains are banked in rear by the engines that brought in their empty coaches, until they have cleared the bridge, as we shall see when we travel down to Ramsgate next month. This is seldom done on the Brighton side, however, even the "*Southern Belle*," with its weight often over 400 tons, going up with a "King Arthur" unassisted. But I fancy that when the "*Newhaven Boat Express*" gets to its maximum loading of nearer 500 tons this rear-end assistance is probably necessary.

When the train is getting well away towards Clapham Junction, there comes a slack over Pouparts Junction, more pronounced in the up direction than the down; and after that, before the engine has had time to recover, a sharp rise to Balham Junction. From there onward, although there are one or two level strips, the grades are almost entirely against the engine until we have

entered Quarry Tunnel, by which the North Downs are pierced north of Merstham. From there we sweep downward to Earlswood and Horley; up through Three Bridges to Balcombe Tunnel; and down through Haywards Heath to Wivelsfield where, at Keymer Junction, we have to slacken severely in order to diverge to the left for the Lewes line. Through Lewes itself—a most sinuous stretch of line—there is an even worse and more prolonged slowing. In view of these hindrances we cannot expect to find the "*Newhaven Boat Express*" timed at a very high speed.

Punctually at 10 a.m. we leave Victoria. If we have not been banked in rear, we shall probably breast the rise on to Grosvenor Bridge at little over 20 miles an hour. Presently, just after the Eastern Division main line has left us for Ramsgate and Dover, we cross the Western Division main line and bear round to the right to come down and join ourselves to the immense width of trackage that heralds the approach to Clapham Junction. This well deserves its reputation as one of the busiest stations in the world; it claims to handle no less than 1,730 trains every day. Immediately after passing through, in about six minutes from the start, we bear left and part company from the Western Division lines again. On the more level stretch through Streatham and Norbury we may attain well over 50 miles an hour, later slowing through the maze of junctions that bring us on to the London Bridge main line at Windmill Bridge Junction, prior to stopping at East Croydon. I use the word "maze" advisedly, as this certainly must be one of the most exceedingly complex railway layouts that exist on the surface in any part of Great Britain.



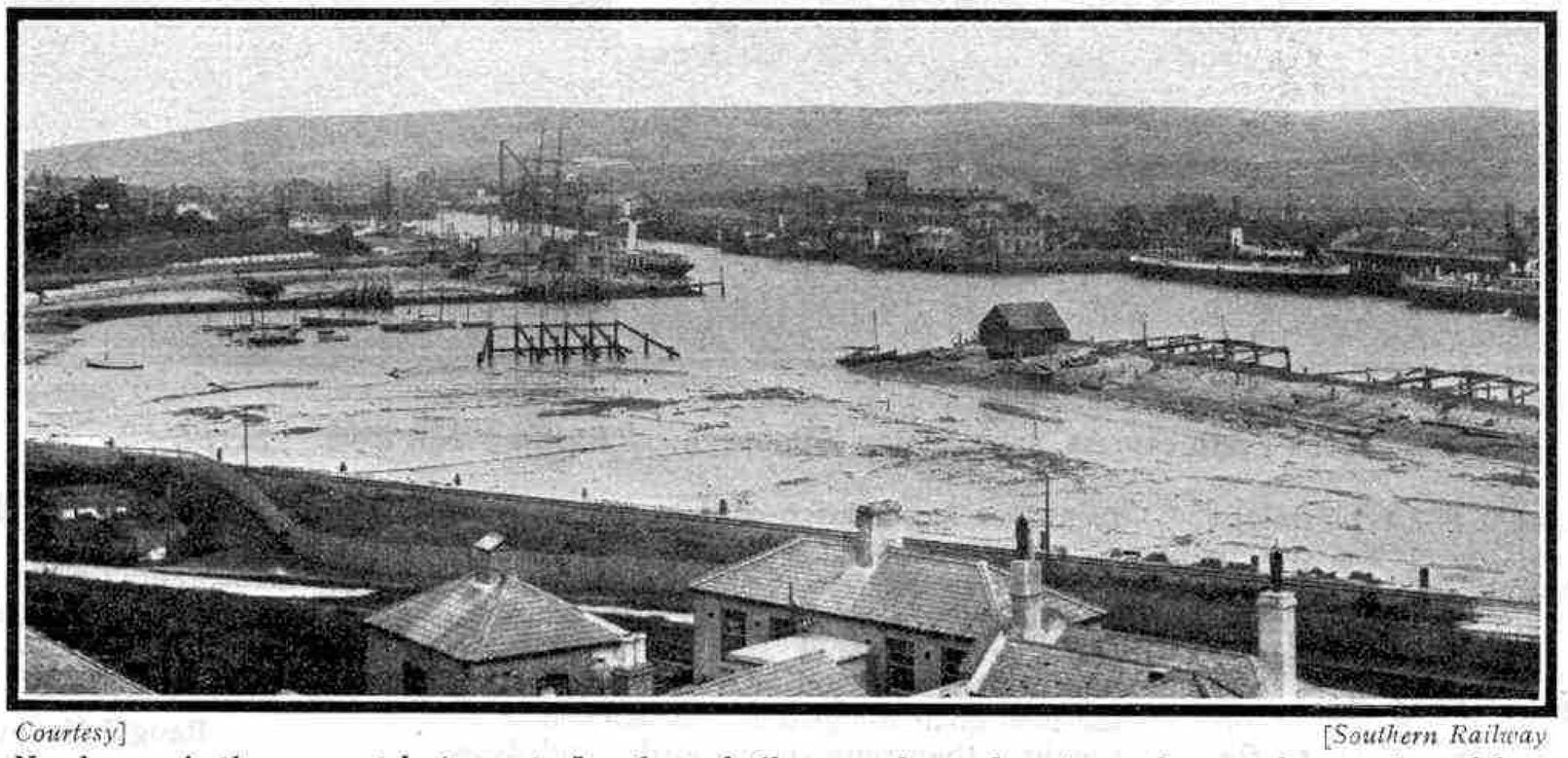
Photograph] [*Railway Photographs, Liverpool*

"*Newhaven Boat Express*" at speed near Earlswood. The engine is an "Atlantic" (No. 41) of the original series, which have now been rebuilt and superheated

I well remember once coming up in the opposite direction, when my train, with portions from Brighton and Worthing, had been divided from Haywards Heath. We were delayed by signals somewhere about Purley, with the result that the second part, which had been turned on to the "Local" line at Coulsdon, caught us up. Then there ensued a most exciting "neck-and-neck," which continued with the two trains in sight of each other the whole way to Victoria; and the two times of stopping at the terminus must have been identical, to the second. The most thrilling moment of all occurred at these Croydon junctions, where the second part, sticking to the "Local" lines, which change here from one side of the main lines to the other, dashed right underneath us!

The Croydon stop of the "*Newhaven Boat Express*" is a relic of the times when there were two parts of the train, one from Victoria and the other from London Bridge, which were joined together here. Even now that all the Continental traffic of the Southern has been concentrated at Victoria the Croydon stop is still maintained, because of the importance of the local connections. We are due to leave there at 10.19 a.m., and for the 46 miles from East Croydon to Newhaven Harbour we are allowed the ample time of 67 minutes. The line rises at 1 in 264 through Purley to Coulsdon, where we bear rightward across the original Redhill main line to get on to the "New" line, opened by the late Brighton Company in 1900 to give relief to their fast traffic to Brighton, Eastbourne, Newhaven and Worthing.

This avoiding line begins with a peculiar "covered way" under some private grounds, which the railway company was compelled by their owners to make; here for a short space the gradient is 1 in 100 up. Then, as we mount through a deep chalk cutting—presently crossing the old main line by a skew girder bridge—the grade settles to 1 in 165 up, until we enter Quarry Tunnel, which we do at about 40 miles an hour, or less. The gradient now falls, and by the time we emerge, a mile later on, we are getting towards the mile-a-minute rate. On the falling grades we accelerate further, the speed of passing Horley, where we rejoin the old route, being probably 65 or more; and if the driver be so minded we may have got up to 70 or 75 by Horley, although the booking of this train hardly renders such speeds necessary. Now we have to rise at 1 in 264 to Balcombe Tunnel, passing on the way the junction at Three Bridges; and by the time the four lines converge to two at Balcombe Tunnel Box we shall be down again to about 50 miles an hour.

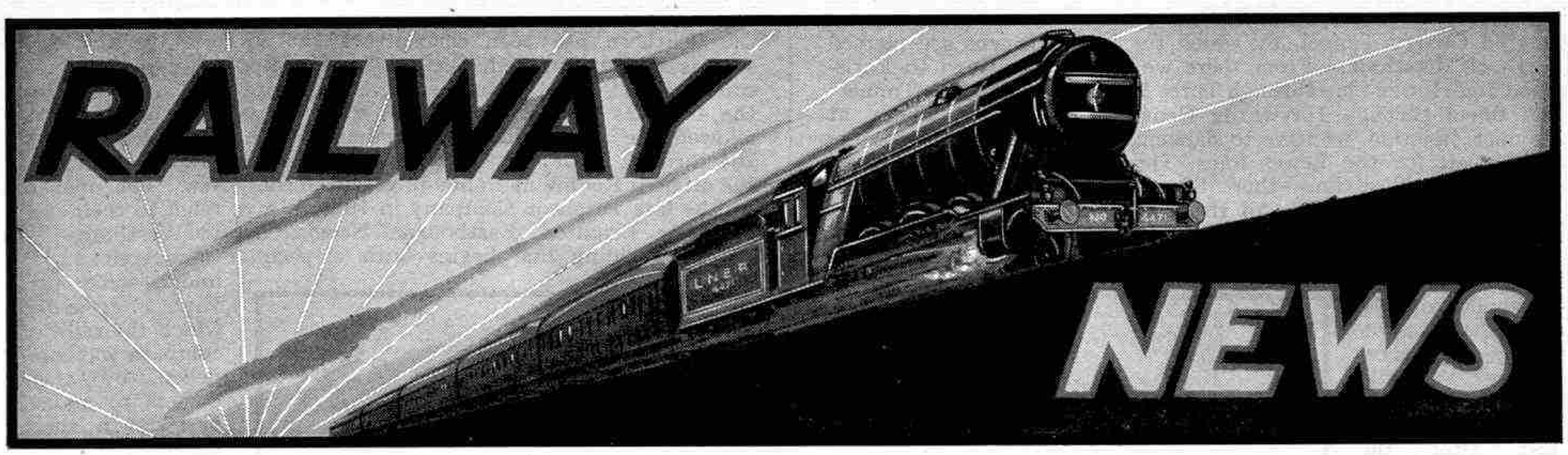


Courtesy] [*Southern Railway*

Newhaven is the nearest but one to London of all cross-channel ports, and a regular service of fast turbine steamers is maintained with Dieppe, on the French coast

Now comes another swift descent, past Balcombe, over the fine Ouse Viaduct, through Haywards Heath at anything up to 70 miles an hour or so, and then down to 30 at Keymer for the junction. After once again regaining speed, we may reach the "sixty" line as we descend across open country towards Lewes. The approach to the county town is heralded by a tunnel, in which we reduce speed to a snail's pace, as the station is on an extremely sharp curve. If we are through Lewes in 55 minutes from East Croydon time-keeping will offer no difficulty, as the rest of the journey is flat.

On leaving Lewes we appear to be making straight for the great rampart of the South Downs, but almost immediately we bear right again, and presently, at Southerndown Junction, diverge to the right again from the Eastbourne line. A level run alongside the tidal River Ouse, and ere long masts and funnels and other evidences of maritime activity bear into view. We run slowly through Newhaven Town Station, past the "through" annexe of Newhaven Harbour Station, to Marine Station, with the Dieppe steamer at the quay alongside, at 11.26 a.m.



L.M.S.R. Locomotive News

L.N.W. 4–6–0 No. 5953, "*Buckingham*," was seen recently working to Glasgow (Central) via G.S.W. route, hauling a football special from Crewe. C.R. 0–8–0's Nos. 17993–4–6–7 and 0–6–0ST's Nos. 16102, 16150, 16215, 16220–5–7–9 are to be withdrawn from service.

On the Wirral Section 2–4–2T No. 6762 and 0–4–4T No. 6776 are still in service.

L.N.W. 2–4–0's seen at Carlisle include Nos. 5027, "*Franklin*"; 5032, "*The Queen*"; 5034, "*Glow-worm*"; 5053, "*Humphrey Davy*"; 5054, "*Antelope*"; 5068, "*Miranda*"; and 5069, "*Penrith Beacon*."

The following 2–4–0 "*Jumbos*" are still in service:—Nos. 5000-3, 5005, 5011, 5012, 5014, 5018, 5020-1, 5023, 5027, 5029, 5031–2, 5034, 5041–2, 5045, 5048, 5050, 5053–4, 5062, 5064, 5068–70, 5075, 5084, 5087, 5092, 5095, 5102 and 5104 (total 36).

The first of a hundred 0–8–0 type freight engines being built at Crewe, was put in traffic on the 30th March. These engines are a modernised version of the G.2 class also built at Crewe.

"Pacific" Engines' Long Runs

It is interesting to note that the "Pacific" engines that have hitherto hauled the Scotch expresses over the East Coast route (L.N.E.R.) between King's Cross and Edinburgh (Waverley) are now to extend their runs to Dundee!

Refuse Destructors at Swindon Works

The directors of the G.W.R. have authorised the construction of two refuse destructors at the Swindon Works. These are to be used for dealing with the wood chippings and sawdust produced in the works, and will be equipped with boilers for raising steam for the wood-bending plant, drying kiln, and shop heating.

New L.M.S. Wagons

A special vehicle in the form of a trolley wagon for carrying heavy electric transformers and other exceptional loads up to 80 tons in weight has recently been placed in service on the L.M.S. Both the main girders of the new trolley are detachable, being secured to the main bolster by means of steel clutches in such a manner as to relieve the connecting bolts of any buffer draw stresses. The girders are also fastened together by means of cross tie bolts and diagonal braces. Thus it is possible to take up a load that is placed in the well until the girders are relieved of its weight; then remove one girder and draw out the load without the necessity of raising the load clear of the trolley before drawing it out. The brakes are applied by means of four compound hand levers, two on each side of the trolley.

New Engine Shed at King's Cross

The original engine shed built at King's Cross in the year 1850 is to be pulled down, and a new one erected in its place, so that 200 locomotives may be housed instead of 150 as at present. The water storage tank is to be enlarged to a holding capacity of 70,000 gallons.

L.N.E.R. Locomotive News

New engines noted include No. 2725 (0–6–0); 2754, "*Rutlandshire*"; No. 2755, "*Berkshire*"; and Nos. 2679 and 2680 (0–6–0T's). G.N. 4–4–2 No. 4419 recently worked between Newcastle and York. N.B. 0–6–0 No. 9046 was noted on a goods train at Darlington.

L.N.E.R. Locomotive No. 5110, "*King George V*," has been seen working on the Cheshire Lines expresses recently. Nearly all the N.7, 0–6–2T's of the 400, 800 and 900 series have now left the G.N. section in London. Recently numbers 2637–41 of the 2632 series were seen working at Hatfield. N.1, 0–6–2T's have replaced locomotives Nos. 2632–36 on the Hatfield section.

A short time ago the Liverpool (Lime Street) to Newcastle restaurant car express (Ripon 6.20 p.m.) was hauled by the G.N. 4–4–2 booster fitted locomotive No. 4419; the train has to climb into Harrogate; hence the need for this powerful engine.

The distant signals between Pateley Bridge Junction and Nidd Bridge are now painted yellow.



Photograph] [*R. D. Stephens*

Noon York-Perth express, approaching Edinburgh. "Pacific" No. 2568, "*Sceptre*"

Bengal-Nagpur Railway

An order has been placed by the Bengal-Nagpur Railway with the Metropolitan-Cammell Carriage, Wagon and Finance Co. Ltd., for 80 iron ore bogie hopper wagons of 66 tons capacity and 90 tons gross weight. These wagons will have a higher capacity than any yet built for service in India. The order also includes 20 bogie rail wagons, each of 64 tons gross weight.

Green Railway Bridges

The L.M.S. Railway have agreed to paint the majority of their bridges in Derbyshire green, to tone with the landscape.

G.W.R. Locomotive News

0–4–2T has been rebuilt with a domeless boiler, and generally works on the Wallingford branch.

It is now certain that more than 50 of the 57XX class of 0–6–0 pannier tank are being constructed, No. 5757 having been noted at Old Oak Common Depot. Many of the second batch of "Hall" class locomotives have been turned out from Swindon Works since March. These include Nos. 4921, "*Eaton Hall*"; 4922, "*Enville Hall*"; 4923, "*Evenley Hall*"; 4924, "*Eydon Hall*"; 4925, "*Evensham Hall*" and 4927, "*Farnborough Hall.*"

The following new engines have been turned out from the Swindon Works since 12th March:—Passenger 4–6–0, No. 4920, "*Dumbleton Hall*" (Hall Class). Goods 0–6–0T, No. 5750.

Goods 0–6–0T, Nos. 5718–24, 5736 and 5738–43, have been received from the North British Locomotive Co. Ltd., Glasgow.

S.R. Locomotive News

In addition to B.607, No. B.453, 0–6–2T, is still in the March black livery.

Locomotive 2–6–0 No. E.804 was seen recently hauling a "Continental Express" at Newhaven. This service is generally worked by 4–4–2's.

The following engines are still in service: Nos. E0.128, 0.149, 0.150, 0.316, 0.328, 0.331, 0.335, 0.410, 0.411 and 0.413 (0–6–0ST's).

The new 3-cylinder 4–4–0 "Schools" class locomotives are to be named as follows:—"*Eton*," "*Winchester*," "*Wellington*," "*Charterhouse*," "*Lancing*," "*Tonbridge*," "*Sherborne*," "*Dulwich*," "*Westminster*," "*St. Paul's*," and will be numbered A.900–A.909.

Pullman Cars on G.W.R.

It is understood that Pullman cars are to be introduced on the Great Western Railway on the section between Plymouth and London, and also on the special boat trains that meet ocean liners calling at Plymouth. Pullmans are used also between London and Torquay.

Tablet to George Stephenson

To celebrate the centenary of the success of the "*Rocket*," a tablet to the memory of George Stephenson, "one of the greatest Tynesiders who ever lived," was unveiled by the Lord Mayor of Newcastle. It was the joint decision of the North-East Coast Institution of Engineers and Shipbuilders, and the Institution of Mechanical Engineers of whom George Stephenson was the first president, that this tablet should be erected on his birthplace. This has now been renovated, being in need of repair owing to tourists making gaps in the wall by taking stones away as souvenirs.

Cardiff Docks Station Improvements

For some time past, owing to the existence of only one platform, 300 ft. in length, and served by one line, at Cardiff Docks passenger station, great difficulty has been experienced in dealing promptly with trains following in quick succession. Improved accommodation has lately been provided. The alterations comprise the provision of a platform 700 ft. in length by 30 ft. in width, adjoining Bute Street, and served by two lines, with a covered approach from the road; the laying down of an engine siding, the demolition of the goods shed, and transfer of the bulk of the goods business to the Newtown goods depot. Two mileage sidings, two carriage sidings, and exchange sidings, capable altogether of holding 176 wagons, have been laid in to replace accommodation interfered with.

The complete remodelling of the junctions involved the provision of new signal boxes at Bute Road and Bute Street.



Courtesy] [*South African Railways & Harbours*

A train-load of maize in 21 special grain trucks

Mr. Ford and "*The Rocket*"

A replica of "*The Rocket*," the famous locomotive that won the Rainhill trials at Liverpool 100 years ago, has recently been completed by Messrs. Stephenson & Co., locomotive engineers, of Darlington, to the order of Mr. Henry Ford.

New G.W.R. General Manager

Mr. J. Milne, C.S.I., who has recently been appointed to the position of General Manager to the Great Western Railway, in succession to Sir Felix J. C. Pole, joined the company's service as a pupil in the Locomotive Department at Swindon in 1904, and has been Assistant General Manager to the company since March, 1924.

Railway Developments in Canada

Since the construction of the Canadian Pacific Railway the development of Western Canada has proceeded rapidly and industry is spreading westward from the Red River to the Rocky Mountains and beyond into British Columbia. This trend of development has led in turn to the construction of new railways and it is interesting to note that in some of the mountainous regions caterpillar tractor trains are now in service. It is contemplated in the near future to extend railway facilities into Northern British Columbia, and it is thought that this is likely to open up an immensely rich territory only recently explored by geologists. During the next five years the C.N.R. and C.P.R. will be building some 2,000 miles of track in practically uninhabited areas in Northern Alberta, Saskatchewan and elsewhere.



The above photograph, which has been sent by one of our readers, K. Bindoff, shows 4-4-0 locomotive No. 247, of the Southern Railway, at Ramsgate, hauling an express from Victoria

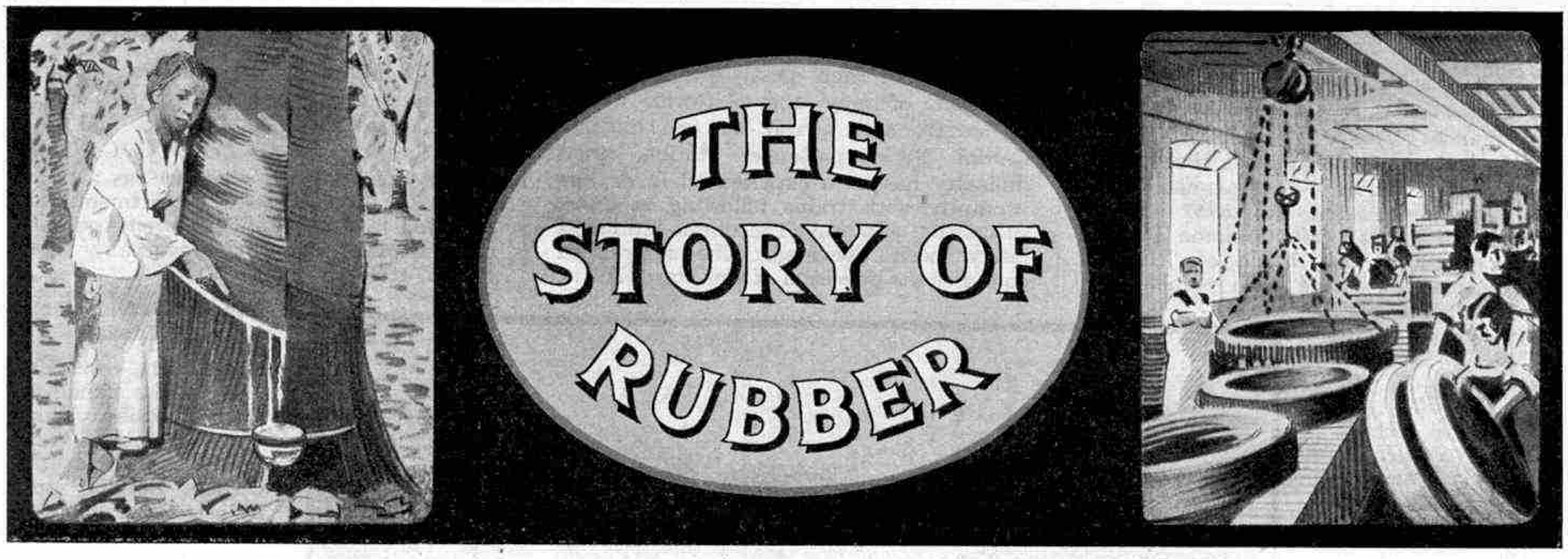
"*Queen of Scots*" Covers 185 Miles in 164 Minutes

Two of the fastest runs ever recorded on the London-Newcastle route were made by L.N.E.R. drivers recently. The "up" "*Flying Scotsman*" was seriously delayed, and left Newcastle for London 66 minutes late; while a further delay of 15 minutes was caused by track repairs. Driver Gutteridge succeeded in regaining nearly 40 minutes of the lost time, and the train reached London only 42 minutes late, instead of nearly an hour-and-a-half.

An even better run was accomplished on the same day by Driver Sparshott with the "*Queen of Scots*." This train left Leeds 14 minutes late and was further seriously delayed through track repairs, being held up for 27 minutes! The train reached London exactly on time, after having travelled the 105 miles from Grantham in 96 minutes and the 185 miles from Leeds in 164 minutes—an average speed of over 67 miles an hour.

Gauge Conversion in Chile

Last year the Antofagasta (Chile) and Bolivia Railway completed the conversion of the whole of its 2 ft. 6 in. gauge section to a gauge of one metre. The work has taken two-and-a-half years to complete, and 530 miles of track have been altered, including the main line to Bolivia.



IV.—HOW MOTOR TYRES ARE MADE

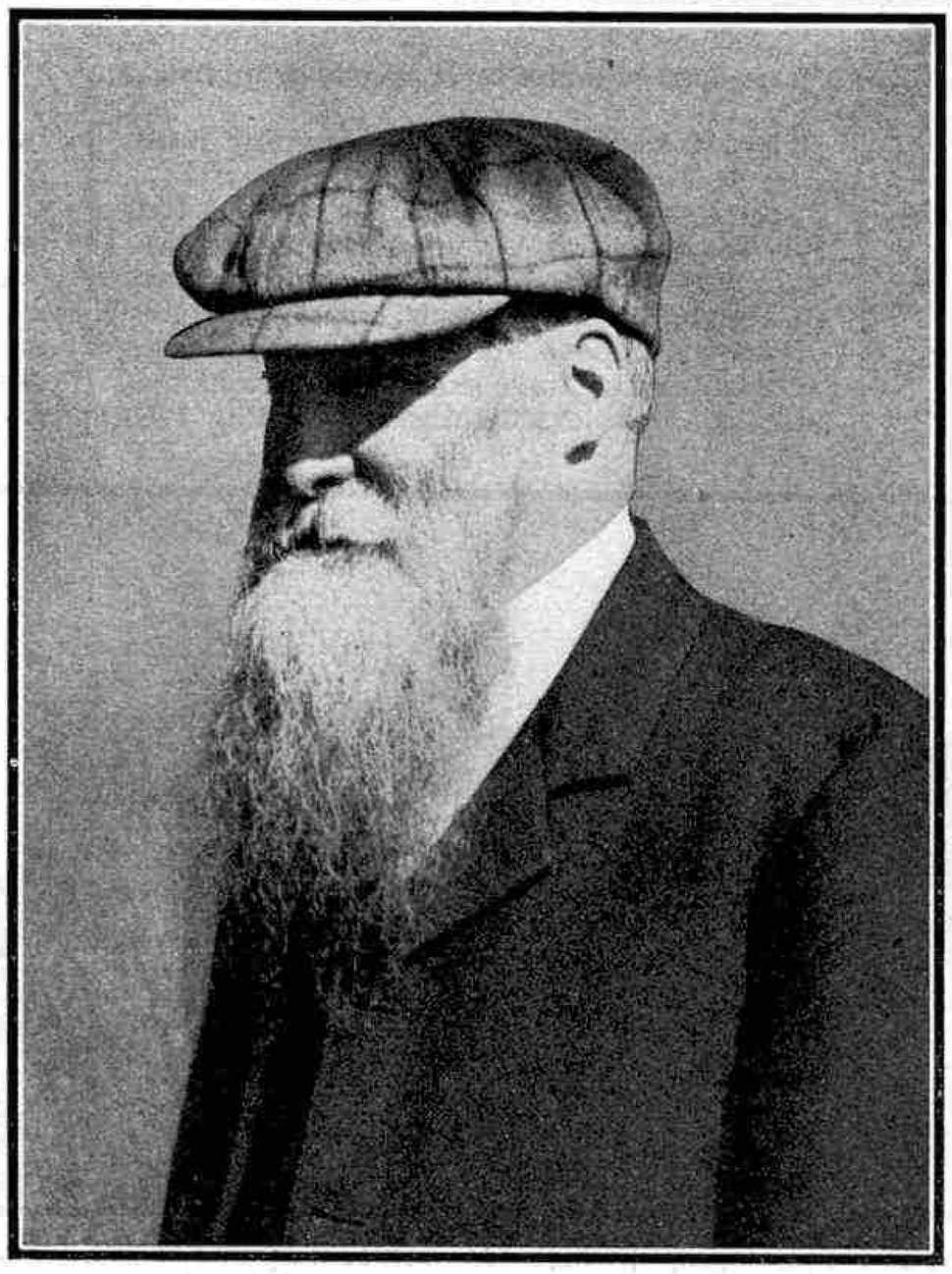
THE most important of the many uses of rubber is in the manufacture of tyres for motor vehicles of all descriptions. Millions of these tyres are required every year, and to-day the tyre industry gives occupation to enormous numbers of people. Some idea of the number of tyres required may be gained by considering the number of motor cars on the road and multiplying each one by five, that is, a tyre for each of the four wheels and for a spare wheel.

Before describing the processes involved in the building up of a modern motor tyre it will be of interest to recall how tyres were invented. The first air-filled tyre was invented as long ago as 1845 by an Edinburgh civil engineer named Thomson who, although having little knowledge of rubber, devised a tyre that consisted of sections of leather laced together, and equipped with an air container made of fabric that had been saturated in rubber solution. His invention was too premature to be successful, however, for neither motor cars nor bicycles were in existence at that period.

Although Thomson's pneumatic tyre did not attract much public attention and was soon forgotten, the inventor appears to have been convinced that his idea was of practical value, and he is said to have had a part in the manufacture of the first solid rubber tyres to be used on heavy steam vehicles. These tyres were made in 1868, and one account describes them as "huge vulcanised rings of rubber." Each of these massive tyres measured 1 ft. in width by 4 in. in thickness, and weighed more than 6 cwt.

During the period from 1870 to 1875 light solid rubber tyres came into general use and they remained in favour until the invention of the pneumatic tyre by John Boyd Dunlop, at Dublin.

Dunlop was a veterinary surgeon, but from an early age was greatly interested in all systems of locomotion. In his professional work he frequently made use of rubber, and one day, probably while he was using the substance, the idea occurred to him that by binding rubber tubing round the wheel rims of light vehicles much of the discomfort and slowness then experienced in road travel might be eliminated. After giving much thought to the matter Dunlop commenced experiments and succeeded in making a tube out of a piece of sheet rubber. This tube was provided with a short rubber pipe similar to that fitted in footballs. He then made a small wooden disc wheel and bound the rubber tube round it by means of a strip of linen tape, after which he inflated the tube with a football pump and secured the pipe with string. He then carried out comparative tests between his pneumatic-tyred disc wheel and an ordinary wheel equipped with one of the solid tyres then in common use. The pneumatic-tyred wheel proved superior both in respect to speed and smooth running, and convinced Dunlop that his invention was of practical value.



John Boyd Dunlop, the Dublin veterinary surgeon, who invented the Pneumatic Tyre

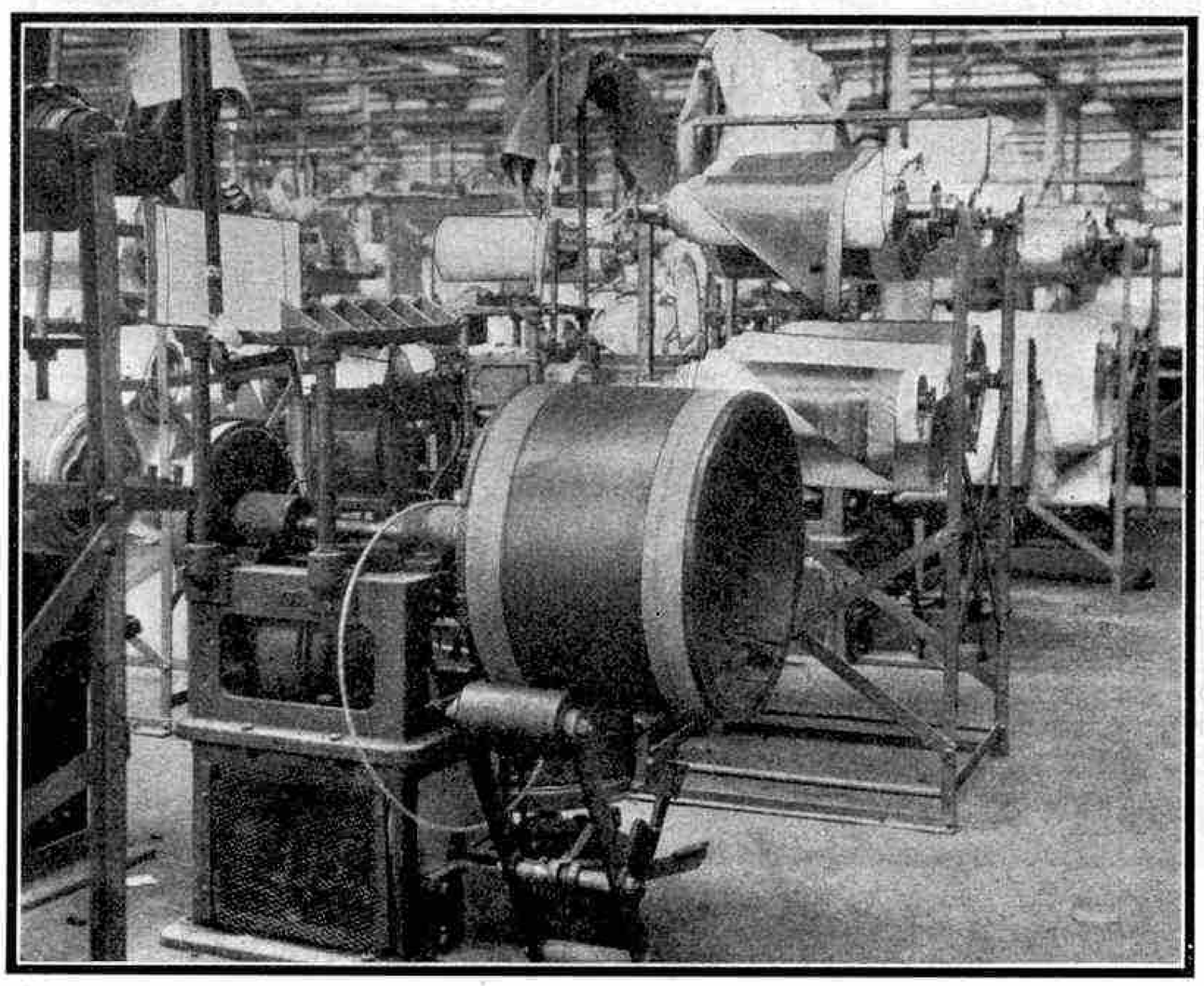
Dunlop then constructed two wooden rims and equipped them with tyres, the inner tubes of which were enclosed in strong canvas covered by a rubber tread of graduated thickness. He then fitted the pneumatic-tyred wheels to his son's tricycle, and improved the running of the machine to such a marked degree as to confirm his belief in the practical value of his invention.

Accordingly, in July 1888, Dunlop applied for a patent for "an improvement in tyres for wheels for bicycles, tricycles or other road cars." The patent was granted to him in December of the same year.

Many experiments were carried out under Dunlop's personal supervision with a view to improving the invention, and about 100 tyres were made during these trials. Among the numerous innovations that were introduced

was that of cementing a strip of rubber into the bed of the metal rim of the wheel to prevent the rubber tyre from chafing or breaking up when in use.

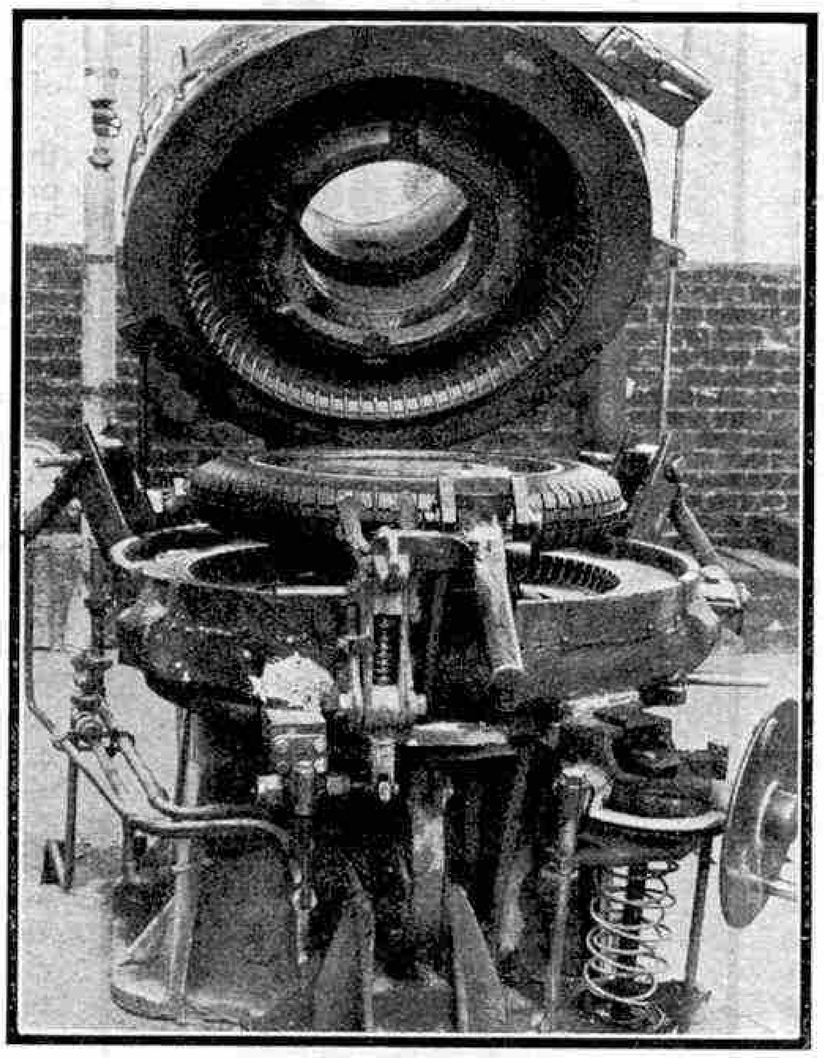
During the latter part of 1888 Dunlop invited several prominent racing cyclists to examine and test at the Ormeau Park Track, Belfast, a cycle equipped with pneumatic tyres. His invitation was accepted, but of those who attended the only rider who became favourably impressed by the pneumatic tyred machine was H. Hume, a crack rider of the Belfast Cruisers' C.C. In consequence of a serious mishap during a cycling competition that year Hume had retired from the sport, but he was so impressed with the superior running of the Dunlop-tyred machine that he decided to ride such a cycle competitively, as soon as a favourable opportunity happened to present itself.



The casing or outer cover of a tyre being built up on the specially designed pulley. For the photographs on this page we are indebted to the Dunlop Rubber Co. Ltd.

Hume's chance came at a sports meeting at Belfast on the 18th May in the following year. All the other cycle competitors had solid tyred machines, and Hume's cycle created much amusement among both competitors and spectators. Various uncomplimentary titles were bestowed upon it, such as "steam roller," "mud cart" and "pudding wheels." Hume ignored the chaff, and when he won the first race in which he competed, easily defeating the other competitors, the derision of the spectators gave place to respect and astonishment. Later Hume competed in three other cycle races at the same meeting and on each occasion he won easily.

Among the expert competitors defeated by Hume were three sons of a well known Dublin resident named Du Cros. This gentleman was greatly impressed by Hume's achievements and foresaw great commercial possibilities in the pneumatic tyre. He was quick to take advantage of the invention and, entering into negotiations with Dunlop, he purchased the patent rights of the invention for £500 in cash and £3,000 in fully-paid shares in a company to be formed to exploit the new tyre. This company was organised in the same year and named the Pneumatic Tyre Company, and it was the forerunner of the huge organisation now known as the Dunlop Rubber Company Ltd., whose headquarters are at Birmingham.



A view of a tyre mould showing the inside of the mould engraved with the pattern of tread to be impressed on the tyre

The pneumatic motor tyre does not consist entirely of rubber, the foundation of the outer cover or "casing" being built up of strips, or "plies," of a cotton fabric designed to withstand the severe stresses and shocks to which a tyre is subjected when in use. These "plies" are thickly coated with rubber, which holds them together.

From the beginning of the motor industry until comparatively recently cotton canvas was used in building up pneumatic tyres. The material was made up of longitudinal and cross-threads, interwoven. When the tyre was in use, the additional internal friction due to the cross-thread construction could, especially in respect of an insufficiently inflated tyre, produce so much heat as to reduce tyre life very considerably.

A definite advance was achieved when "Cord" material was adopted for the cover casing. In this material the interwoven cross-thread construction is eliminated, the cord consisting of parallel-laid strands of suitably prepared cotton fibre. The necessary casing strength is obtained by using a number of plies of the cord, cut on a bias and so assembled that the threads of adjacent layers are transverse to one another and at an angle of approximately 45 degrees to the cover edges. The individual cords and the plies are insulated by means of rubber compound. The advantage to the tyre user of this improved construction is to be found in the greater mileage that is being obtained from cord tyres by comparison with canvas tyres used under similar conditions.

The cord fabric is received from the spinning mill in the form of rolls, the pieces of material being approximately 250 yds. in length by about 2 yds. in width. When any deleterious substance has been removed the fabric is dried thoroughly by passing it through steam-heated radiators, after which it is passed through a bath of rubber solution. The rubber thus absorbed by it acts as a protective agent and prevents the fabric from chafing and speedily breaking up in use.

The material is then coated on each side with a rubber compound by passing it and the compound between the steam-heated revolving rollers of a calender. In this machine one roller moves faster than the other, and the

effect of this difference in speed is to thoroughly work the rubber into the fabric. This process is known as " frictional calendering," and was referred to when describing the general treatment of raw rubber in the previous article in this series (see "*M.M.*" of June last).

When calendering is complete, the rubber-coated fabric is again dried, after which it is cut into plies, the length and breadth of which vary according to the size of tyre for which they are intended. As already mentioned the plies are cut in a special manner, and in use have their threads at an angle of approximately 45 degrees to the cover edges.

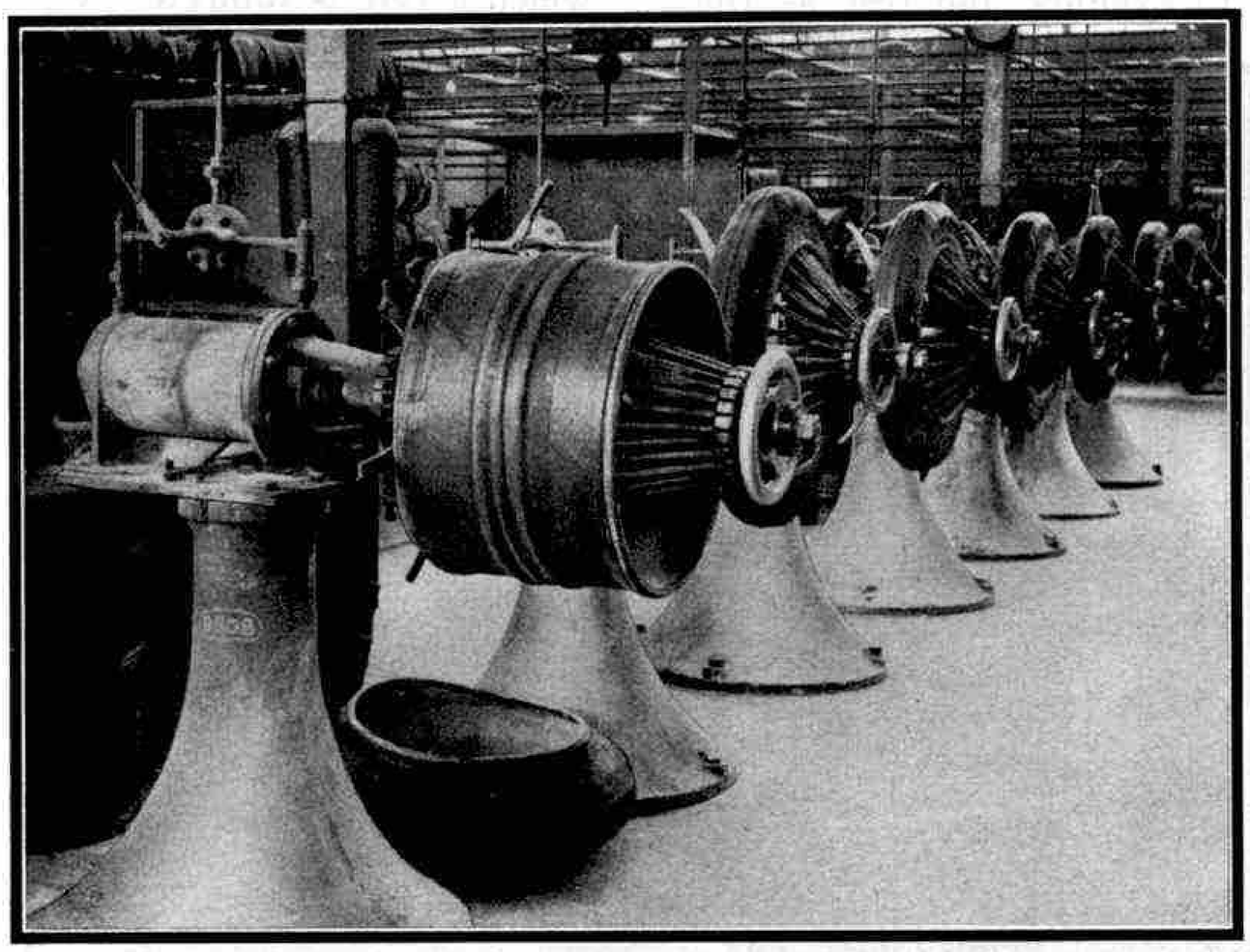
While the cord fabric is being prepared in the manner just described other parts necessary in building up the outer cover or casing of the tyre are being made in adjoining shops. These parts are the " tread " and the " wire beads." The tread is the series of notches round the circumference of the tyre that prevent the tyre from skidding when in use. The tough rubber compound from which the tread is formed is passed between heated rollers, one of which is of special design and roughly shapes the tread. The wire beads are a vital part of the tyre and are made from high tensile steel wire about 1/16th of an inch in diameter and having a breaking strength of approximately 120 tons per square inch. One or more coils of wire are used in each bead according to the size of casing for which they are being prepared; and the ends of the wires are joined together suitably. The wires are then covered with rubber compound and the whole is wrapped with impregnated canvas.

We now come to the " building-up " of the tyre casing. This operation sometimes involves the use of a " core," a broad flat pulley that rotates on a spindle. The plies of cord fabric are laid round the pulley in such a manner that the oblique cord threads of one layer lie from left to right, and the cord threads of the next layer of fabric from right to left. When several cord plies have been wrapped round the pulley in this alternate fashion the machine is stopped momentarily while the rubber-covered wire beads are placed in position on the cord. The machine is then re-started and, as the pulley revolves, additional layers of cord fabric are wrapped round as before, until the casing is completely built up. The operation is largely mechanical, the work of the operator consisting merely of maintaining the supply of cord material, regulating the speed of the core, and seeing that the machine functions efficiently.

When the required number of cord plies have been laid the tread is fitted on top of the casing, and the cover—in the form of a broad band—is then transferred to an expanding chuck. This is a hydraulically operated machine and consists of a projecting horizontal shaft that carries an umbrella-like framework around which is mounted a broad drum. The tyre casing is slipped on to this drum and the framework is then opened out, causing the drum to expand and extending the tyre cover so that it is shaped roughly to its finished form.

The casings for very large tyres are not built up on a rotating flat pulley in the manner that has been described, but are assembled on a machine that carries a core similar to the form of the tyre cover. The rubber-coated plies of cord fabric are laid round this core in the form of a band and are spun down by means of revolving discs. The wire beads are then fitted, after which additional plies are laid on until the tyre casing is completely built up, when the tread is added. The casings so built do not require to be placed on an expanding chuck to give them the rough shape of a finished tyre.

The tyre cover, by whatever method produced, is now ready for moulding and vulcanising, but before these operations are effected a special inner tube is inserted in the cover.



Courtesy [*Dunlop Rubber Co. Ltd.*

Tyre casings being shaped roughly on expanding chucks. The foremost chuck shows a casing as it is before being shaped

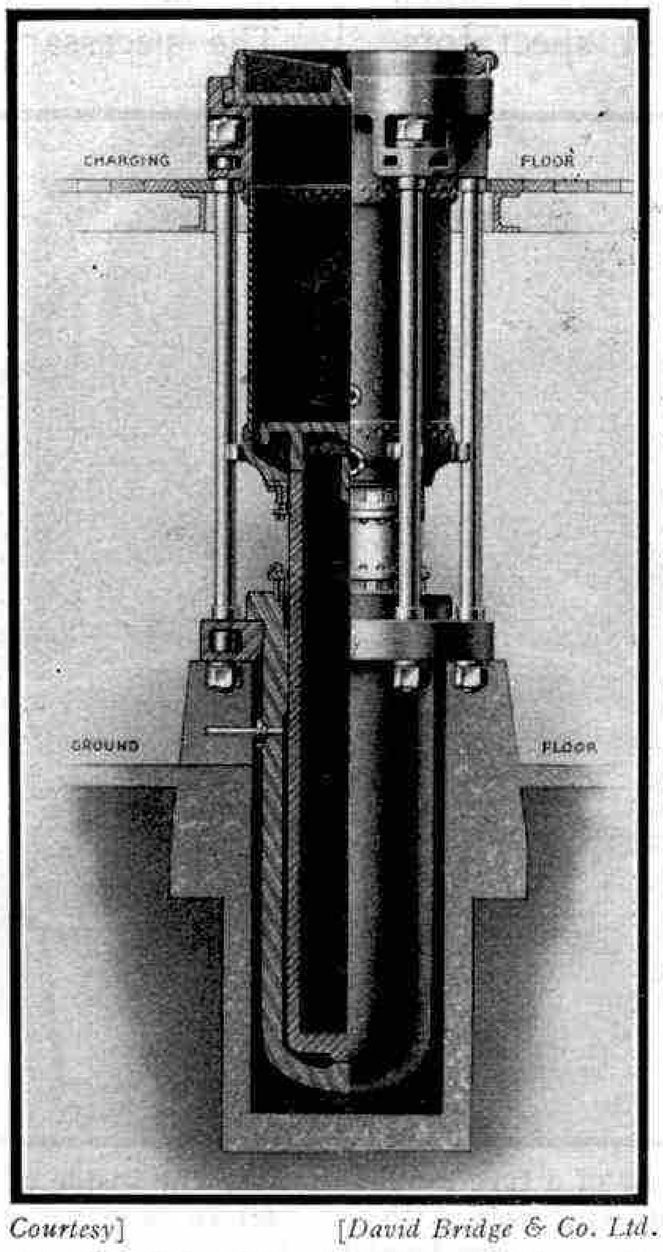
The rubber compound in plastic form from which the ordinary inner tubes—not the special tube just referred to—of pneumatic tyres are made is fed into a machine having a horizontal cylinder, with a powerful screw revolved by belt gearing at one end of the cylinder. The other end is tapered to hold a heated die shaped to the section of the tyre that is required. The rubber compound is fed into the machine through a rectangular opening in the roof of the cylinder, and under pressure the compound emerges from the heated die in tubular form. The tube is then fitted on a circular shaped mandrel and placed in a steam-heated chamber in which vulcanisation takes place.

After removal from this chamber the tube is forced off the mandrel by compressed air. The air valve is then fitted into position and the tube made into an endless length by bevelling the tube ends and vulcanising them together while under pressure in a circular collar. When these operations have been completed the tube is inflated and is tested thoroughly in water to ensure that it is absolutely airtight.

Moulding and vulcanising is done in a steam jacketted mould. The pattern of tread for the tyre is machined inside the outer part of the mould, and a new mould is neccessary for every variation in the form of tread and size of a tyre.

Immediately the tyre is placed in position the special inner tube is inflated from a high pressure air main and the steam valve is opened. The heat of the steam gradually softens the rubber while the pressure from the inflated inner tube forces the tyre cover to fill the mould; and in this way the tread pattern on the inside of the mould is permanently impressed upon the tyre. After the required period of heating the tyre becomes vulcanised and it is then removed from the mould and allowed to cool. Subsequently it is examined, cleaned and wrapped ready for despatch.

Vulcanisation is sometimes carried out in huge vertical machines called hydraulic tyre vulcanising presses, which can deal with several tyres at the same time. These machines tower to a height of 20 or more feet, and the upper half consists of a vulcanising chamber into which moulds, each containing a tyre, are inserted from an elevated " charging floor." The lower half of the machine consists of a chamber that accommodates a massive vertical piston. When the upper chamber has been filled, the lid is clamped down and water is forced beneath the piston, which is then hydraulically thrust upwards, keeping the tyre moulds closed. At the same time steam is passed into the mould chamber and the combination of pressure and heat moulds and vulcanises the tyres. When this treatment has been carried on for the requisite period the steam and water are drawn off, the piston sinks to its normal position, and the moulds are removed from the upper chamber. The tyres are then taken from the moulds and subjected to a close examination, and unless some fault is observed they are prepared for despatch.



Courtesy [*David Bridge & Co. Ltd.*

Sectional view of a " Bridge-Williams " vertical hydraulic tyre vulcanising press

A Stephenson Picture Mystery

Can Any Reader Help?

THE accompanying illustration is of particular interest to all who are familiar with the life of George Stephenson. It is an engraving, in the possession of Mr. W. F. Dickinson of Darlington, that apparently shows George Stephenson explaining to a miner the principle of the safety lamp that he devised in 1815. The engraving bears the inscription :— "Painted by John Lucas, engraved by Francis Holl, London. Published August 30th, 1862, by Henry Graves & Co., the Proprietors. Publishers to H.M. the Queen, 6, Pall Mall." A photograph of the engraving has been presented by Mr. Dickinson to the Railway Museum at York, and we are indebted to the L.N.E.R. for permission to reproduce it.



Nothing is known of the original picture by John Lucas, neither is it known whether the other figures in the picture are representations of actual persons. These people do not seem to be interested in George Stephenson's talk. The woman in the foreground is busy reading, and the other two women and the child appear to be keenly interested in something the old man is saying. Perhaps his remarks have something to do with the colliery engine seen in the background, which strongly suggests that the picture represents a part of the colliery of Killingworth.

We wonder whether any of our readers can tell us where the original painting by John Lucas is to be found, or throw any light upon the identity of the figures ?

George Stephenson went as brakesman to the West Moor Colliery at Killingworth in 1804. To outward appearances his prospects did not seem very bright, but actually he had his foot on the first rung of the ladder that was to lead to world-wide fame. A sad period was immediately ahead, however. His wife died soon after he had settled at Killingworth, and not long afterwards his father met with an accident that rendered him totally blind and reduced him to poverty. Stephenson promptly came to the rescue, and moved his old father and mother to a cottage close by, where he supported them in comfort for many years.

We are not now concerned with Stephenson's first attempts at locomotive building, but with his invention of a safety lamp for miners.

At that time explosions of fire damp were unusually frequent in the fiery mines of Northumberland and Durham, and these explosions were usually attended with serious loss of life. Several instances of this nature occurred at Killingworth while Stephenson was employed as brakesman, and they made a deep impression upon his mind. He realised that what was required was a lamp that would give sufficient light without communicating flame to the dangerous gas that accumulated in certain parts of the pit, and in his spare moments he commenced to experiment with the object of producing such a lamp. He ascertained that an ordinary flame would not pass through tubes of very small diameter, and on these lines he produced a thoroughly practical and safe lamp.

The miner's safety lamp that is best known is, of course, the "Davy" lamp, invented by Sir Humphry Davy. This lamp was based upon the same principle as that of Stephenson, and a great controversy took place as to which inventor was first in the field. There was no doubt that in some respects the "Davy" lamp was superior to Stephenson's so-called "Geordy" lamp, but at the same time it was beyond dispute that Stephenson actually produced his lamp before Davy had his ready. Sir Humphry Davy was naturally a much more important person in the eyes of the public than Stephenson, and the latter's claims were to a large extent ignored.

At the request of his friends, Stephenson published in 1817 detailed plans and descriptions of the various safety lamps he had devised for use in the Killingworth colliery. This pamphlet of 16 pages thoroughly convinced a large number of influential people of the justice of Stephenson's claim to priority, and a subscription was started with the object of providing practical recognition of the value of his work. In due course the subscription amounted to £1,000. With some of this money a silver tankard was purchased and this, with the remainder of the money, was presented to the inventor at a public dinner held in Newcastle. Greatly as Stephenson appreciated this recognition, he valued far more a silver watch bought by small sums collected from the miners and presented to him by them as a token of their regard for him personally, and of their gratitude for his life-saving invention.



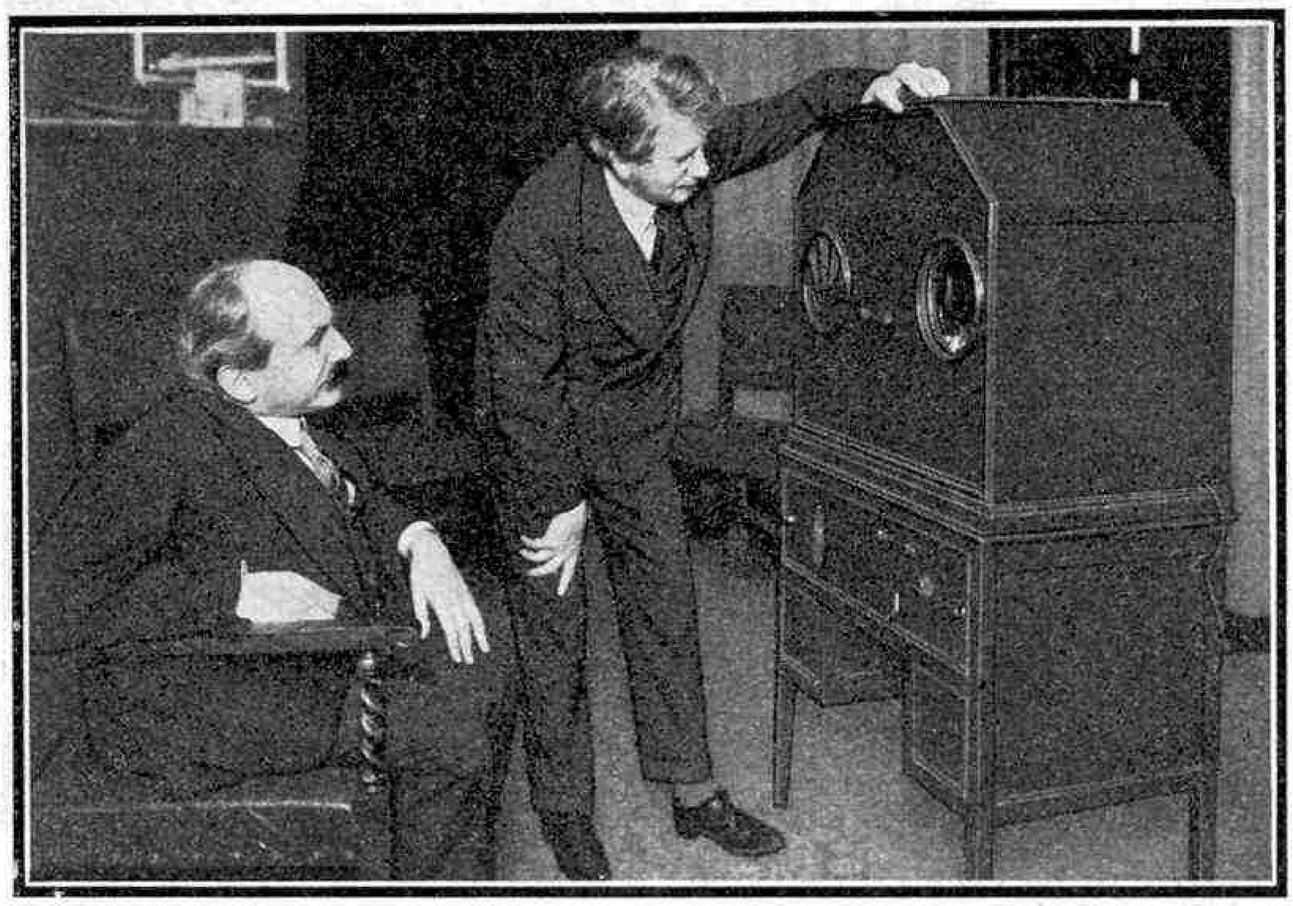
II.—HOW THE PICTURE IS TRANSMITTED

LAST month we told the story of the discovery of two forms of the electric eye, the selenium and the photo-electric cells. It is the latter that is used in practically all television systems, and we showed how by means of it changes in the intensity of any source of light may be reproduced at a distance.

We also compared the electric eye to the human eye, and thus discovered the great defect of the artificial form. This is that it is not a complete eye, but corresponds to only one of the millions of tiny cells that make up the retina, or screen at the back of the eye, on which the images that we see are formed. If we desire to make a complete artificial eye, therefore, it would be necessary to use millions of photo-electric cells at the transmitting end of our television apparatus, and an equal number of neon glow lamps would be required in the receiver. The cost of making a clumsy artificial eye of this description would of course be prohibitive.

Fortunately means to overcome this difficulty have been discovered. We cannot increase conveniently the number of photo-electric cells in the electric eye used in television, but a single cell may be made to do the work of a very large number. By similar means a single neon lamp may be used in the receiver.

In order to bring about this seeming miracle the electric eye is made to look at the object to be "televised" in instalments. Each of these is flashed through the ether, and on reception the fragments are pieced together, each appearing in its correct position. This is done so rapidly that to the eye the portions of the picture appear to be combined into a complete scene.



Mr. J. L. Baird demonstrating a complete sound and sight "Televisor" television receiver. For this and the other photographs illustrating this article we are indebted to Baird International Television Limited

The picture seen by the electric eye is broken up, and its distant reproduction pieced together, by means of what are called "scanning discs." A disc of this kind is a circular sheet of metal, cardboard or other suitable material, near the edge of which a spiral series of holes is punched. The holes are spaced around the disc at equal intervals, and they are staggered by placing them on successive concentric circles. The holes are square, and the length of each side is exactly equal to the distance between two of the series of circles on which they are cut.

In order to see how the scanning disc works in the receiver of a television set, one may be cut from a sheet of stiff cardboard, mounted on a spindle, and rotated in front of a lamp. A suitable holder may easily be made from Meccano parts. The light should be enclosed in a tin box in the end of which a hole is cut, in order that diffused light may be screened off. On the opposite side of the rotating disc a second piece of white cardboard may be used to act as a receiving screen. A small square of transparent paper or grained glass may be used instead of this, in which case the image may be seen from the opposite side.

When a disc fitted up in this manner is turned very slowly a beam of light passes through each hole in turn and falls on the receiving screen. The holes are so widely spaced that only one spot of light appears on the screen, and as the disc rotates this moves slowly upward until it disappears when the top of the screen is reached. A similar spot of light then comes into view at the bottom end of the screen, and it also moves upward in exactly the same manner.

Each hole in turn brings about the same result, and if the paths of the successive spots of light are marked it will be noticed that each is very slightly to the right of its predecessor. This, of course, is due to the spiral arrangement. When the hole nearest the centre of the disc has passed across the front of the lamp, it is succeeded by one on the outside, and the next spot of light therefore appears on the extreme left of the range.

By rotating the disc more quickly the spots of light may be made to pass upward so rapidly that the eye retains impressions of them after they have moved into new positions, and then they will appear on the screen as narrow vertical tracks of light. These tracks touch each other—it is in order to make them do so that the square holes are made of the size indicated—and thus the whole of the space on the screen between the extreme tracks is covered in instalments by the rapid succession of bands of light.

At still greater speeds the light tracks themselves succeed each other so rapidly that the eye does not lose the memory of the first before the last appears. Then the entire screen appears to be illuminated all the time, although at any moment only a very small section actually is receiving any light. Thus instead of being illuminated by a large number of tiny areas of light projected on to it at the same time, the screen is lit up by an extremely large number that follow each other so rapidly that the eye is deceived into thinking that it sees them simultaneously.

It is very fortunate that the eye does not lose impressions as quickly as it receives them, for otherwise neither the cinema nor television would ever have become practicable. On the cinema screen 16 pictures appear in every second, and it is because the eye is deluded into believing that a picture is still there when actually it has disappeared and the next has been projected on the screen, that the pictures appear to be living and moving things. During the exhibition of a moving picture the screen is quite blank for a considerable portion of the time, but the eye is too slow to detect this!

A scanning disc similar to that described was used by Mr. Baird in his earliest television experiments, and still forms an important part of his equipment. The transmitter uses a spiral disc behind which is a powerful lamp. The holes in the disc allow a spot of light to pass through, and as the disc revolves this spot of light travels over the object being transmitted. The light is thrown back from the object on to a photo-electric cell, and the current from this cell is transmitted to the receiver at the receiving station.

A spiral disc identical with that at the transmitter revolves in

front of a neon tube, and the observer looks at this tube through the holes in the revolving disc. The neon tube is bright when strong current passes through it and dim when weak current passes through it; and the eye, owing to the presence of the disc, sees these bright and dark patches in their proper position on the screen. The flashes succeed each other with very great rapidity, and in order to build up the complete picture each must illuminate the screen in a position that corresponds exactly with that of the area on the original that gave rise to it.

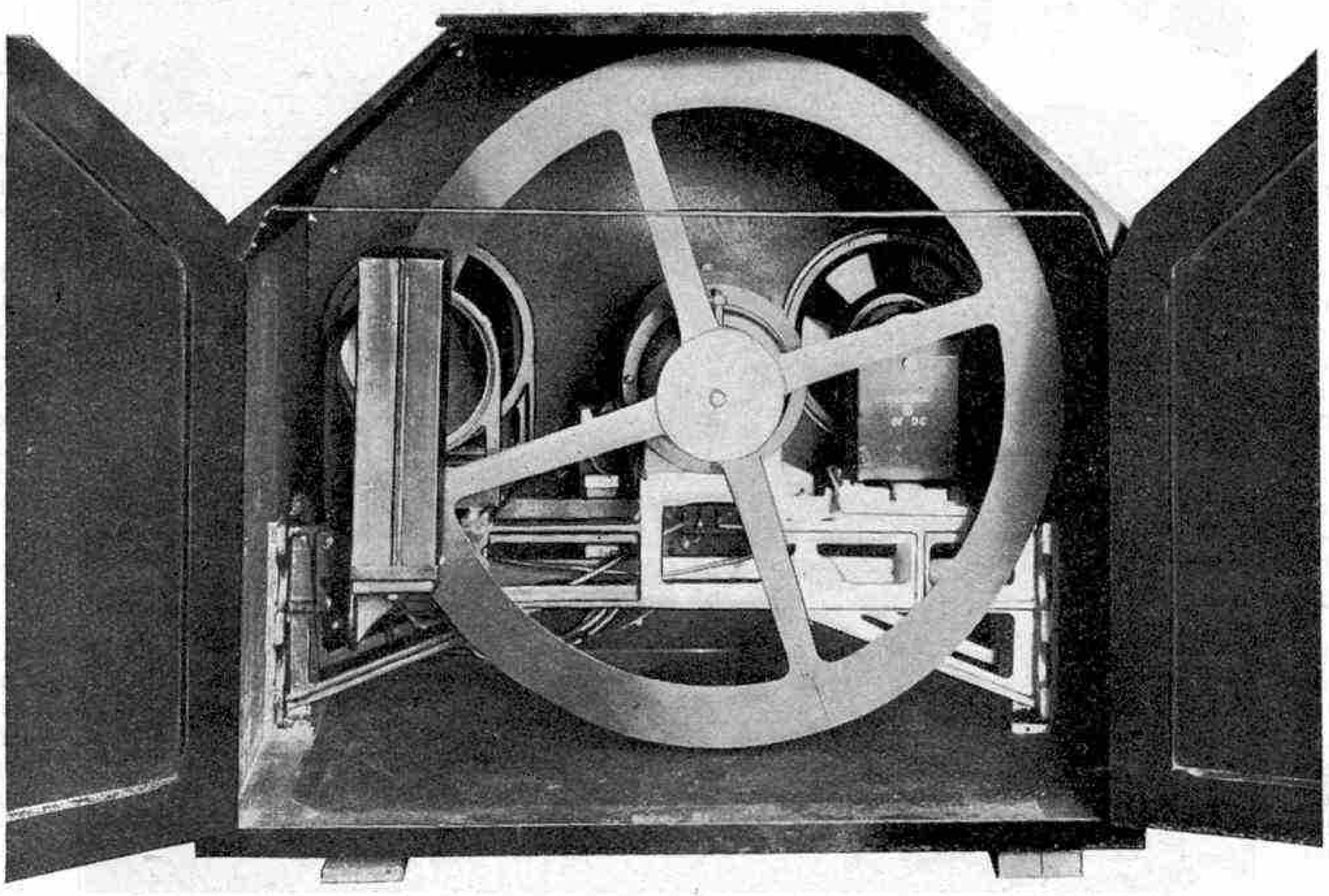
As the discs revolve exactly at the same speed at both the transmitter and the receiver, the receiving disc has the task of completely reversing the action of the transmitting disc and building up the picture again for the observer.

Thus the use of a photo-electric cell in conjunction with scanning discs appears to solve the problem of television. Unfortunately many difficulties are encountered in practice, and these are only being overcome by steady and persistent work. When Mr. Baird commenced his experiments, for instance, he found it very difficult to obtain an electric eye that was sufficiently sensitive; but this trouble now appears to have been overcome.

A second difficulty concerned the means of driving the scanning discs. Those in the two parts of a complete television set must rotate at exactly the same speed for, as we have seen, the receiving apparatus reverses the action of the transmitter. The screen of a receiver in which the mechanism regularly runs faster or slower than that of the transmitter will show the component fragments spread out, and the picture may be diamond-shaped instead of square. If the speeds vary irregularly the result will be even worse, for the picture will then become a hopeless blur, each of the small areas changing position on the screen as the discs rotate.

Scanning discs usually are driven by electric motors, and these must be controlled with great accuracy. It is not sufficient to equip them with rheostats to vary the current, and speedometers to show the rate at which they are rotating; but instead they are automatically driven at a fixed speed by means of synchronous motors. The speed at which a motor of this kind runs depends on the frequency with which the alternating current supplied to it changes its direction, and remains constant so long as the frequency does not change.

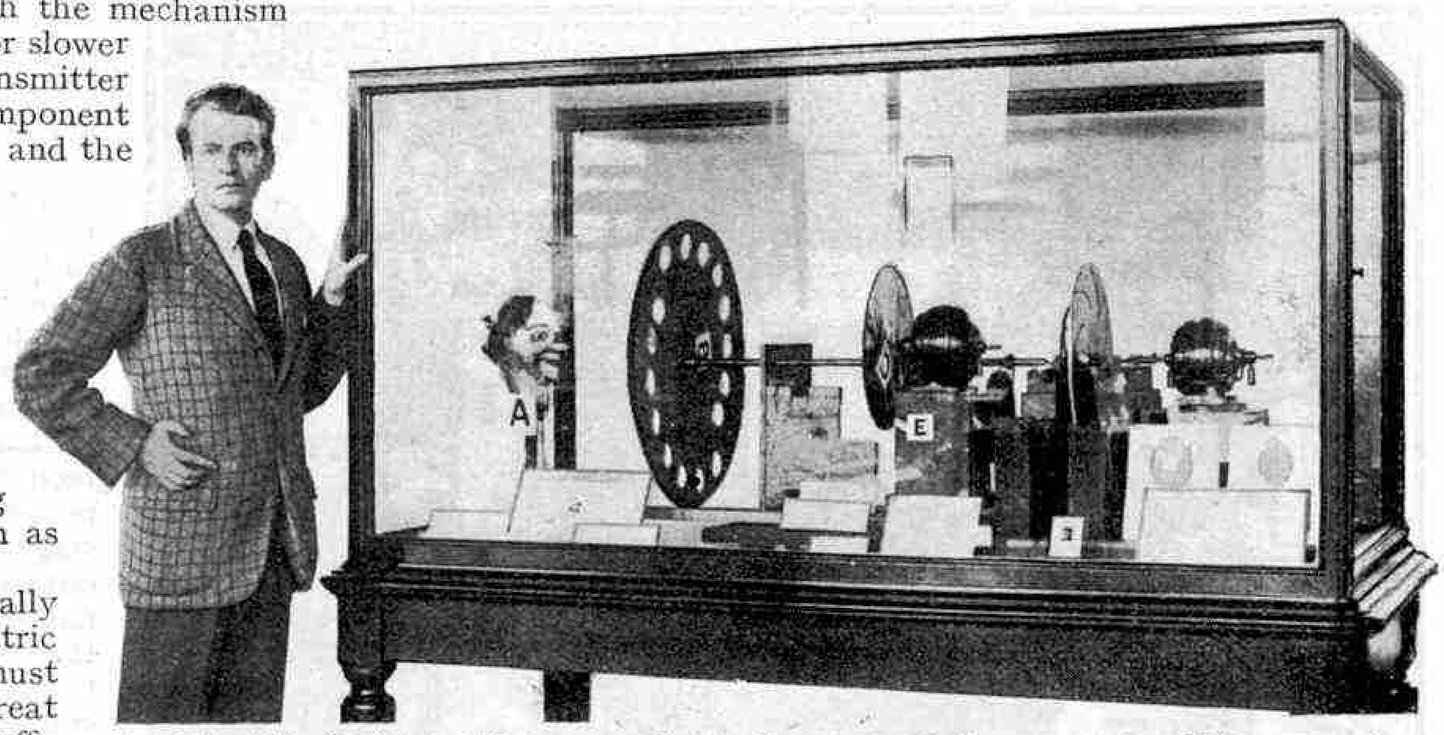
A small synchronous motor in the receiver is indirectly supplied with current from a constant-frequency generator in the transmitter, the actual current from which is used to modulate the carrier wave. The impulse thus sent out through the ether produces a current in the receiving aerial, which is amplified and made to drive the synchronous motor. The latter controls the speed of the discs in the receiver by means of which the picture on the screen is built up, but it is not used to drive them. Instead it is coupled to the shaft of a direct current motor, the speed of which it governs. Thus there is a direct wireless link between the driving mechanisms of the transmitter and receiver and this is of such a nature that the corresponding discs in the two parts must turn at exactly the same speed.



Interior of a Baird "Televisor" television receiver showing exploring disc

No motor rotates at absolutely constant speed — small variations in supply current make that impossible — but this makes no difference in the case of the two under the iron control of the little synchronous motor, for if that in the transmitter speeds up slightly, the one in the receiver follows its example. Similarly a slight slowing down of the first motor is followed immediately by a corresponding decrease in the speed of the one that drives the receiving mechanism.

In order to obtain perfect pictures the two motors must not only run at the same speed, but also they must be absolutely in step, or as electrical engineers say, in phase. This may be made clearer by a comparison with two clocks which, while running at exactly the same speed, show different times, one being perhaps five minutes behind the other. In this case the clocks are out of step. A clock that is always, say, five minutes slow, does not exactly distort time, but may be said to push it a little to one side. Similarly, if the motor in the receiving mechanism of a television set is out of step, the picture on the receiving screen is pushed out of position, although there is no actual distortion unless the speed also is incorrect. If, for instance, a man's face is the object to be transmitted, instead of appearing in the middle of the screen it may be pushed into a corner. Half of it may even be pushed off the edge of the screen, in which case the missing half would reappear on the opposite side, and instead of being joined in the usual manner, the two halves would almost be in contact with each other at the ears!



Model of the first television apparatus to be successfully operated. This apparatus, invented by Mr. Baird, is now in the South Kensington Museum

Fortunately it is easy to correct a motor that is out of phase in this manner. A clock that is out of step may easily be corrected by pushing the hands round, or, what comes to the same thing, turning the whole clock in the opposite direction while leaving the hands unmoved. Similarly a synchronous motor may be brought into step by the simple process of turning it round its spindle.

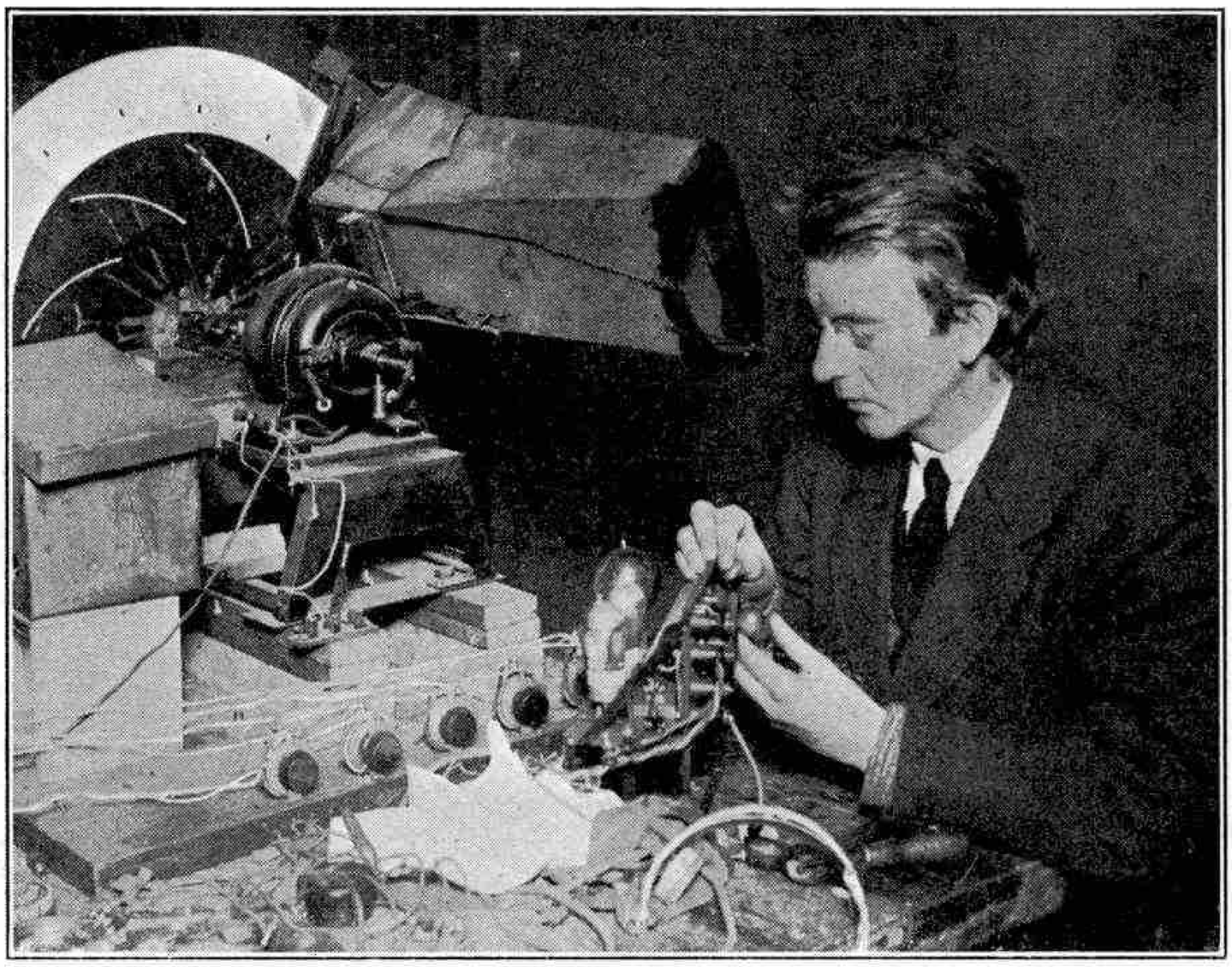
It will be realised that the driving mechanism plays a very important part in television, for if the motors are not doing their work properly it is quite impossible to obtain pictures of any value on the screen of the receiver.

The only drawback of the synchronous motor is that its use involves sending out other impulses in addition to those that are

used for building up the picture itself. Thus in the ordinary way two wireless channels at least are necessary, and three are required if speech also is to be transmitted. Mr. Baird has discovered recently a method of synchronising the driving motors without the use of a second channel. This has proved extremely successful, but so far the details have not been published.

Even when a satisfactory photo-electric cell has been found, and means for rotating the scanning discs at the same speed while keeping them in step have been discovered, there still remain many practical difficulties. The most important of these is concerned with the enormous number of light flashes that must be transmitted per second in order to enable a good picture to be built up. If the picture is not to be too coarse, at least 300,000 flashes per second must be transmitted through the ether!

This number seems almost incredible, but it is easy to see why so many flashes are necessary. The picture on the receiving screen is built up by the swift passage across it of a single spot of light, and this must be of small area if the picture is to be of sufficiently fine grain to be pleasing to the eye. But the spot must appear in each position no fewer than 16 times in every second; for if it did not do so the eye would have time to forget what had previously appeared in the space and parts of the area covered by the picture would remain blank.



Mr. Baird at work on one of his early Transmitters

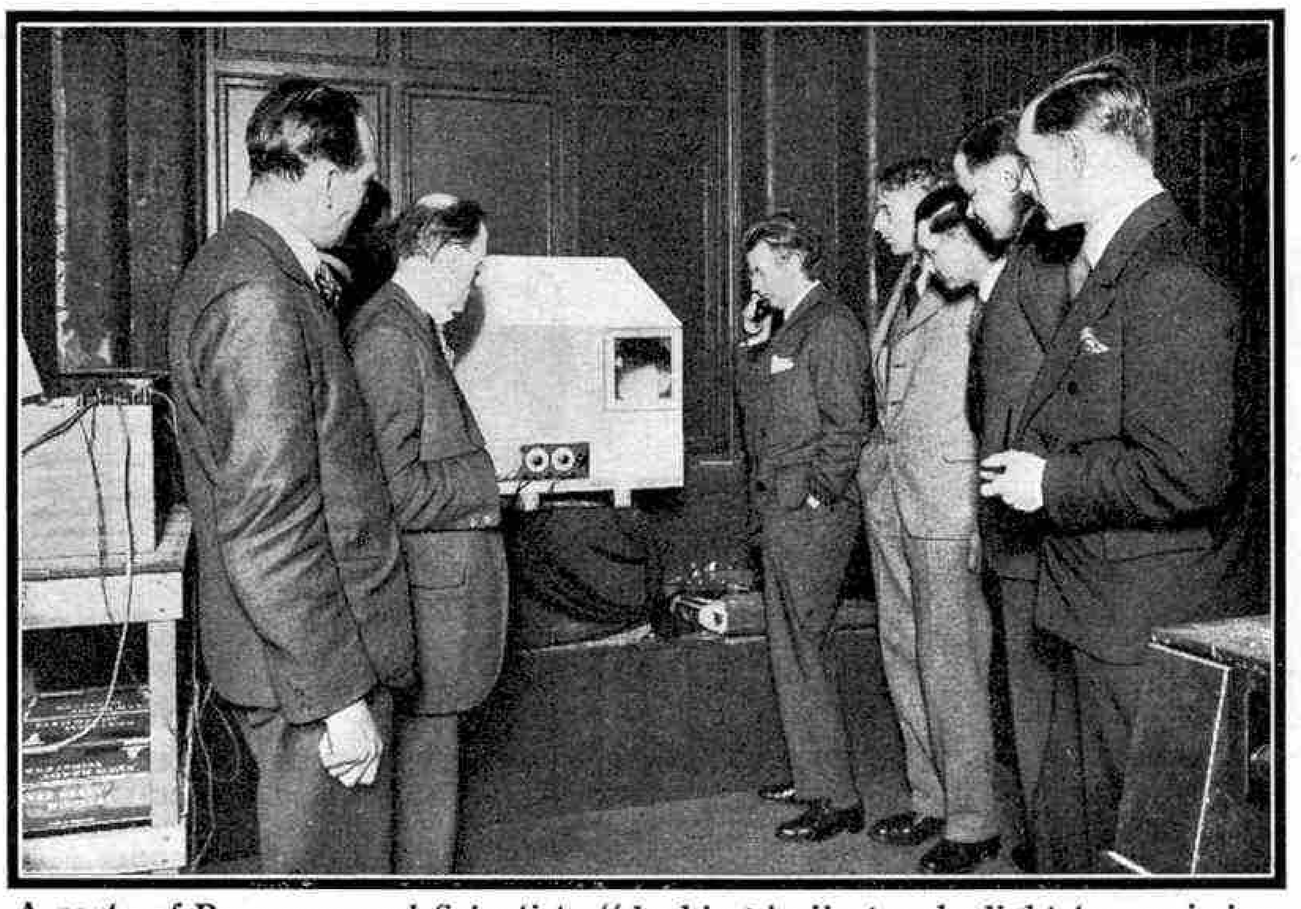
Apart from the difficulty of making an apparatus that will turn scanning discs with sufficient speed to enable the spot of light to take up 300,000 different positions in every second, there is the added difficulty of transmission. It is very doubtful if any wired circuit could transmit impulses at this tremendous speed. Wireless appears to offer the only means of vision at a distance, but in order to enable a satisfactory speed to be attained it is best to make use of short wavelengths. Unfortunately these are subject to fading, and much has yet to be done before they can be used successfully under all conditions.

One suggestion for overcoming the difficulty of transmitting such a large number of impulses is that more than one photo-electric cell should be used in a transmitter and that the impulses should be sent through the ether on carrier waves of different wavelength. The chief objection to such a plan is that the ether is already terribly crowded, and if every television station of the future were to require several different wavelengths the result probably would be absolute chaos.

In spite of this and the many other difficulties that have stood in the way of the accomplishment of television, Mr. Baird has achieved wonderful success. In October, 1925, he had the satisfaction of seeing on a receiving screen the face of the office boy who accidentally became the first human subject of a television experiment. He improved his apparatus steadily and in 1928 he succeeded in spanning the Atlantic Ocean by means of television. He is now able to project on screens images, measuring 6 ft. by 3 ft., of scenes containing as many as 12 people.

Much remains to be done in order to perfect the invention, but television may now be regarded as practically accomplished. It is possible that in a very short time we shall see the commencement of a regular television service in this country, while the merits of Mr. Baird's invention have already been recognised in Germany and successful television transmissions have been produced daily from a Berlin station for some weeks.

Mr. Baird has improved his apparatus in many directions that promise to widen the scope of television. These include television by daylight, instead of with the aid of a blinding glare of artificial illumination; television in colours, and even stereoscopic television. These are important advances for they mean that the pictures that in future will appear on the screens of Baird television receivers may have solidity and depth, features that are lacking in ordinary photographs or cinema screen pictures. In addition they will have a perfectly natural appearance, for they will be reproduced practically in the shades of colour they show in daylight.



A party of Pressmen and Scientists "looking in" at a daylight transmission

The chief importance of the use of daylight instead of artificial light to illuminate scenes to be "televised" lies in the fact that it is the first step towards outdoor television. At the present moment television practically is confined to the transmission of indoor scenes enacted in an area of limited extent and near the scanning discs of the transmitting apparatus. As the technical details of the process are improved, a stage will be reached when outdoor scenes may be flashed to distant parts of the earth. Then it will be as easy to transmit instantaneous views of current happenings as it now is to photograph them on cinematograph films and reproduce them after despatching the record by train or by air.

Much remains to be done in order to make the television transmitter as effective in dealing with open air scenes, such as a Boat Race or a Royal Procession, as it now is in studio work. Photo-electric cells must be made more efficient in order that they may respond to feeble rays of light reflected from distant objects and scanning devices must be improved in order to enable larger reproductions to be shown. But the first steps have been taken, and next month we shall explain how Mr. Baird has transmitted images in their natural colours.

The New S.R. Shunting Engines



The first of a batch of eight new 0–8–0 shunting tank engines for service in the principal S.R. goods yards and sidings. We publish this illustration and the accompanying diagram by courtesy of the "Southern Railway Magazine"

IN the June *"M.M."* we referred to a batch of eight new 0–8–0 type shunting tank engines that have been completed at the Southern Railway's Brighton works. This month we give more details of these engines, which have many interesting features.

They are intended for service in the principal goods yards and sorting sidings on the Southern Railway, and they have been made powerful enough for working trains over humps. At the same time sufficient play has been given to the leading and trailing wheels to allow of the engines traversing curves of 4½ chains radius. The three cylinders that have been adopted give an even turning moment that has been found to be of great value in shunting, as it gives very steady slow movement, while higher acceleration is possible for "fly" shunts.

The Central Section type boiler is particularly suited for shunting purposes as it has large steam and water capacity with a very moderate grate area. Thus heat can be stored while standing, and blowing off at the safety valves minimised; while the stand-by loss of fuel is lessened by the limited grate. Superheating has not been adopted as it is of small value in shunting and other intermittent operations.

The engines are fitted with hand and steam brakes and have a vacuum ejector and piping for working vacuum braked trains. The steam brake valve is graduable by hand application or in combination with the vacuum brake. Steam heating pipes are fitted so that the engines can perform pilot duties with passenger trains when required. The engines are painted black with fine green lines, and are very compact and symmetrical in appearance. A tractive effort of 13.1 tons is obtained on an adhesive weight of 71.6 tons, giving a high factor of adhesion of 5.46.

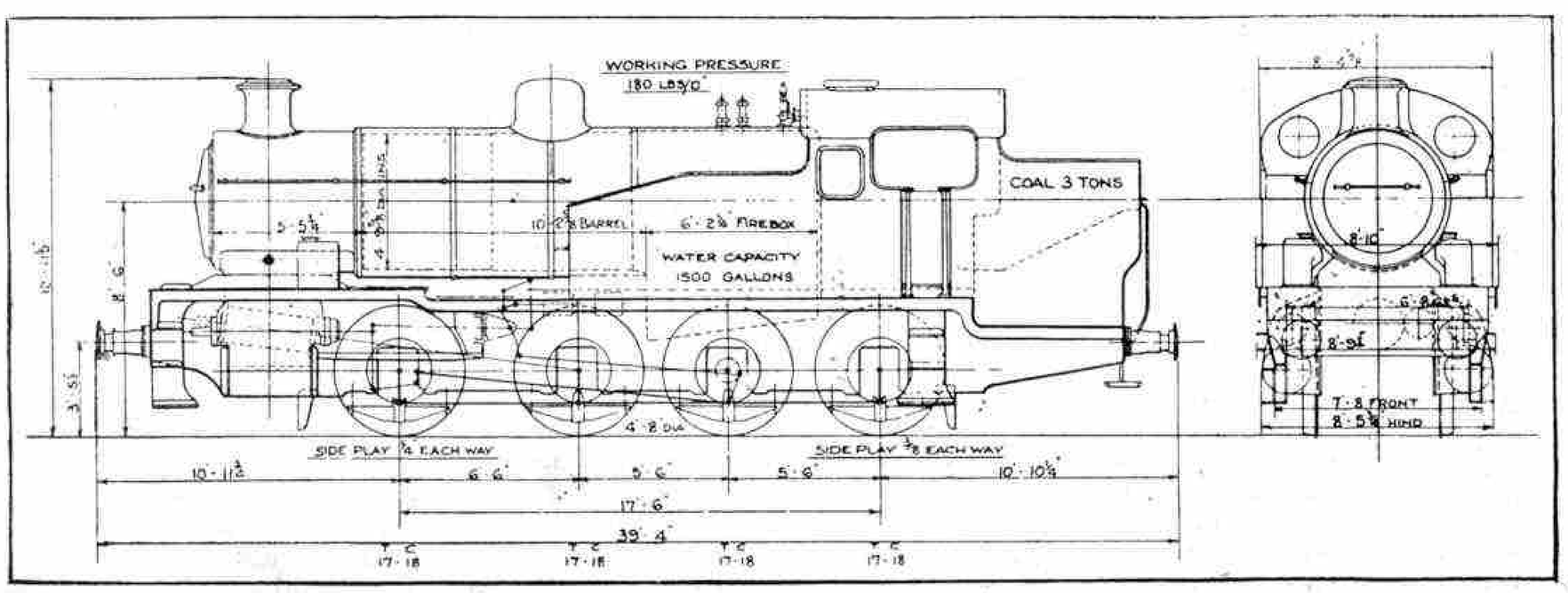
Other details of the engines include hand sanding, standard sight feed lubricator, and steam operated cylinder cocks.

It is interesting to note that these are the first "A" engines to have the driver's position on the left-hand side of the cab.

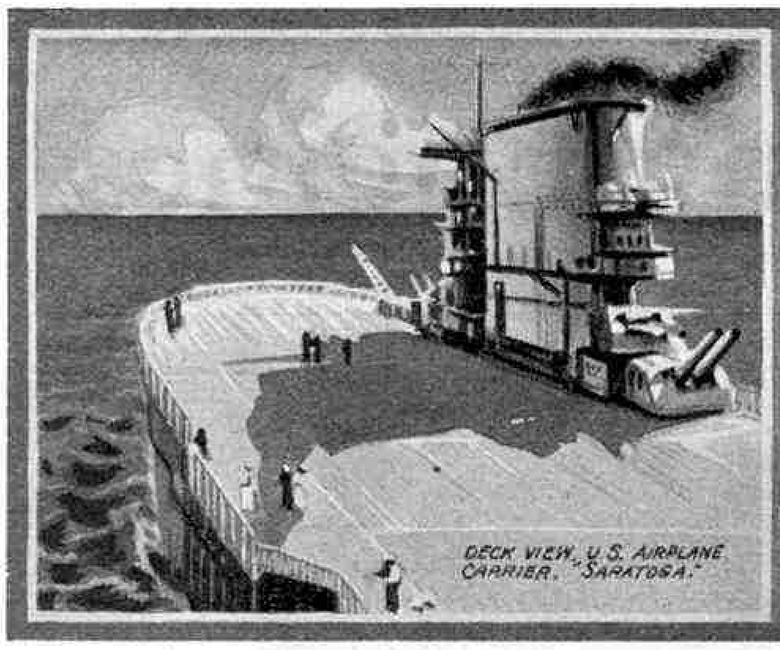
Details are also available of a new class of 2–6–0 passenger locomotive that has been introduced by the Southern Railway. These engines are identical with Mr. Maunsell's "N" Class 2–6–0 type mixed-traffic engines except with regard to wheels and framing. The coupled driving wheels are of 6 ft. dia., while the two outside cylinders are of 19 in. and 28 in. dia. respectively. Belpaire type boilers, pressed to 200 lb. per sq. in., are fitted. They are provided with Maunsell superheater and Ross patent "pop" safety valves. The tenders carry five tons of coal and 3,500 gallons of water.

PRINCIPAL DIMENSIONS:

Cylinders.	
Number	Three
Diameter	16 in.
Stroke	28 in.
Wheels	4 ft. 8 in. dia.
Wheelbase	17 ft. 6 in.
Boiler Barrel.	
Outside diameter at firebox	5 ft.
Length	10 ft. 2⅜ in.
Length between tube plates	10 ft. 7 in.
Firebox Shell.	
Width (outside at foundation ring)	4 ft. 0⅛ in.
Length	6 ft. 2¼ in.
Heating Surface.	
Tubes	1,173 sq. ft.
Firebox	106 sq. ft.
Total	1,279 sq. ft.
Grate Area	18.4 sq. ft.
Boiler working pressure	180 lb. per sq. in.
Weight in working order	71 tons 12 cwts.
Adhesive weight	71 tons 12 cwts.
Tractive effort at 85 per cent. of boiler pressure	5.46
Water capacity	1,500 gallons.
Coal capacity	3 tons



Dimensioned diagram of the new S.R. shunting engine



ENGINEERING NEWS

New Research Station for the B.B.C.

It has been announced that the B.B.C. will shortly transfer their experimental receiving station from Keston to a point near Tatsfield, on the main road from Croydon to Westerham. The station has been at Keston for four years and much experimental work of an important nature has been conducted there, but it has been felt for some time that a more efficient and better placed station was necessary. The new station will be officially known as the Tatsfield receiving station, and the major part of its work will consist of checking the performances of British stations and relaying foreign programmes from time to time.

Plans for Hudson River Bridge not Approved

A paragraph giving details of a proposed bridge across the Hudson River was published in our last issue. It has now been officially announced, however, that unless the plans submitted to the authorities are modified to allow for a 200-ft. clearance above mean high water level at the centre, they will be refused official approval, and consequently it will be impossible for the bridge to be built. Readers will remember that the plans submitted to the War Department allowed for a clearance of only 175 ft. The shipping interests have secured a further respite, but it seems unlikely that the parties who will benefit by the construction of the bridge will abandon the project.

Concrete Bridge for Adelaide

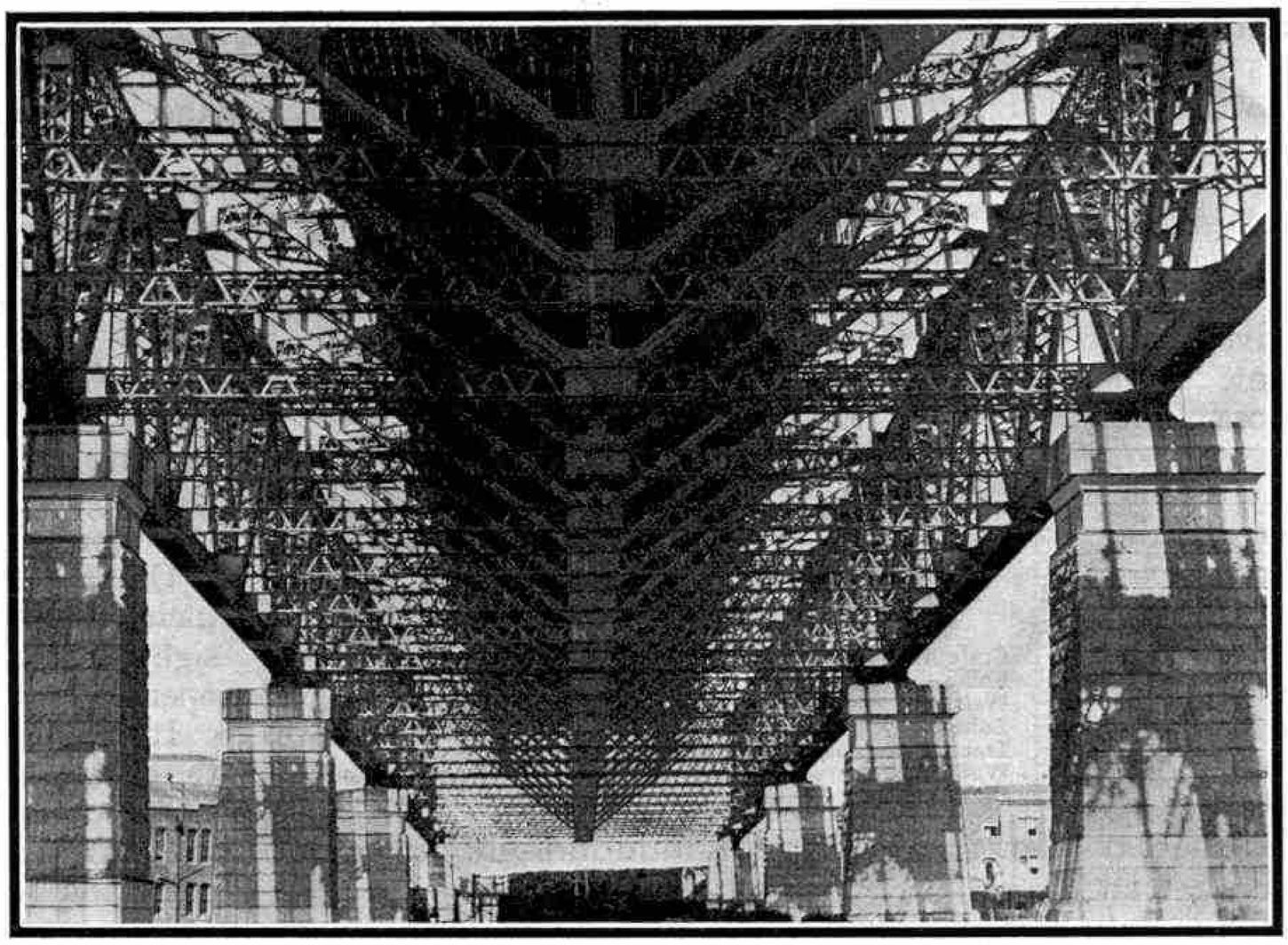
The wrought iron plate girder bridge that at present crosses the River Torrens at Adelaide was built as long ago as 1877, and it has now been decided to replace it with a modern structure. This will be a concrete arch bridge and will have a total length of 221 ft., the main arch having a clear span of 115½ ft. The new bridge is to have a width of 132 ft. in order to give ample room for a roadway that will include two tramway tracks.

Britain again Triumphs in the Grand Prix

This year for the third time in succession the International Motoring Grand Prix d'Endurance was won by a British car. The victory was obtained by Mr. Woolf Barnato, last year's winner, driving alternately with Mr. Birkin. By winning the Grand Prix Mr. Barnato became the winner of the coveted Rudge-Whitworth Cup. The car in which this dual feat was accomplished was a 6½ litre Bentley, and the superiority of British racing motor cars over those of other nationalities is indicated by the fact that the first four places in the race were obtained by British drivers on British Bentley machines. The fifth place was obtained by an American Stutz, after which came two American Chryslers, followed by a British Lea Francis, and two French Tractas.

Huge Russian Motor Factory

Russia is not the country where one would expect to hear of mass production of motor cars, and it is therefore very interesting to learn that at Nizhni-Novgorod a factory is to be built from which an annual output of 100,000 cars is expected. It will employ 12,000 men.



The building of Sydney Harbour Bridge. The approach span at the south side of the harbour. This photograph gives an excellent idea of the maze of girders forming the span. **(See page 622)**

New Use for Waste Straw

A company has been incorporated in the United States for the manufacture from waste straw of a board, to be called "Solomite," intended for use in place of timber in the construction of buildings. It is stated that a machine already in operation compresses straw under a pressure of 100 lb. per sq. in. The product is laced with wire and turned out in boards 14 ft. in length, 5 ft. in width, and 2 in. in thickness. The production of the machine is 4,000 sq. ft. of straw board per day. It is claimed that this board is fireproof on account of the pressure to which it is subjected, and also that it possesses high insulating qualities.

Motor Cycles in India

During the last nine months of 1928 the total number of motor cycles imported into India was 1,274, of a value of approximately £54,000; as compared with 1,450 machines, valued at just under £60,000 for the corresponding period of 1927. Of the motor cycles imported last year, 1,107, or approximately 87 per cent. were British machines.

Motor Buses for Burton-on-Trent

The Burton-on-Trent corporation have decided to do away with their existing electric tramcar service and to replace it by a fleet of motor buses consisting of those already in service together with 18 new ones. The new buses will each have seating accommodation for 28 passengers. The total cost of the conversion is estimated to be £23,560.

New L.C.C. Tramcars

The London County Council have put into service two hill-climbing bogie cars of an entirely new kind. These will operate on the routes that include Dog Kennel Hill, one of London's steepest inclines, and will be among the most speedy and comfortable tramcars in existence.

The Reconstructed Welland Ship Canal

One of the most important of the inland waterways of Canada is the Welland Ship Canal, connecting Lake Erie with Lake Ontario across the Niagara Peninsula, about 10 miles west of Niagara Falls. The original canal was opened in 1829 and extended from Port Dalhousie on Lake Ontario to the town of Port Robinson, where a connection was made for the Welland River. The course followed was down this river to its junction with the Niagara River and thence to Lake Erie. This was not found satisfactory, so between the years 1831 and 1833 the canal was extended along a route from Port Robinson to Port Colborne. The present canal, which is 26.75 miles in length, was completed in 1887, but several years ago it was found entirely inadequate for use by the modern steamships operating on the Great Lakes, and work is now well in hand on its reconstruction.

There is a difference in level of 326.5 ft. between Lakes Erie and Ontario, and in order to overcome this the reconstructed canal will have seven locks each of a uniform lift of 46.5 ft., whereas the old canal had 25 locks of varying lift. In order that there may be complete protection to the canal and the vessels in it, there is being built, in addition to the seven locks, a guard lock near the southern or Lake Erie end of the canal. This lock will be 1,380 ft. in length between the inner gates, and will be the longest lock in the world, approached in size only by two United States locks at Sault Ste Marie, which are 1,350 ft. in length. Some idea of the size of the lock gates may be obtained from the fact that the total estimated weight of metal in them, together with their fixed parts and machinery, is 23,000 tons.

The reconstruction of the canal was commenced in 1913, and although there have been a number of stoppages it is expected that the canal will be ready for service some time next year. The difference in size between the old and the new canals is very evident from the fact that the useable length of the locks in the new one is 820 ft., as against 255 ft. in the old one. The new locks are 80 ft. in width, while the old ones were 45 ft. The canal proper will be 310 ft. in width at the water line and 200 ft. at the bottom. The immense locks are built to take 30 ft. of water on the sills, and the canal reaches will have a normal depth of 25 ft., which may be increased to 30 ft. when the need arises.

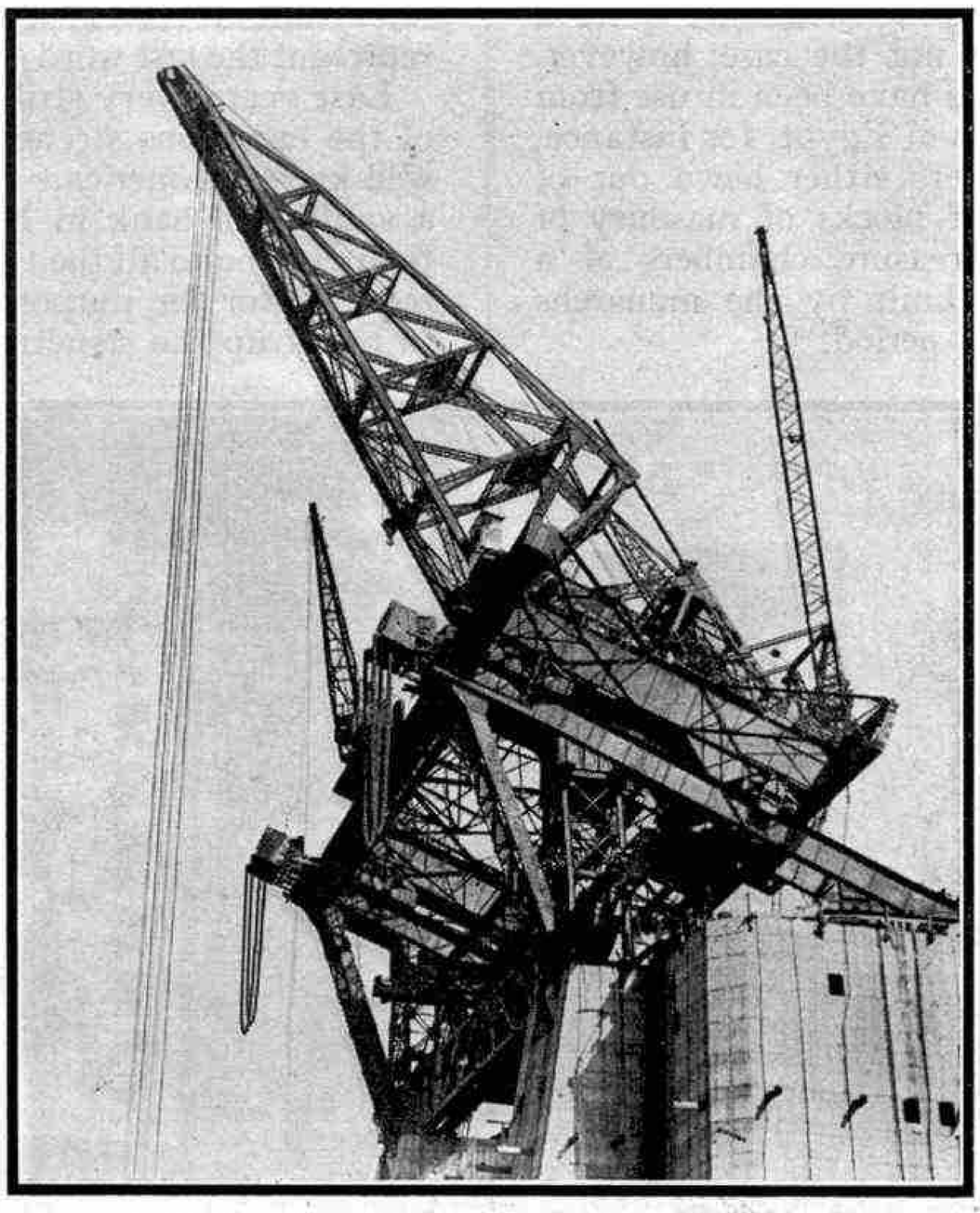
The total estimated cost of the work is approximately £28,750,000. When completed the reconstructed canal will enable upper lakes freight vessels, drawing up to 25 ft., to proceed all the way down to the foot of Lake Ontario.

New Danish Oil Tanker

A Diesel oil tanker of 16,000 tons dead weight has been ordered from the Furness Shipbuilding Co. Ltd., Haverton Hill, by a Danish firm. This will be one of the largest vessels built on the River Tees.

New Electric Furnace

A Vancouver metallurgist has invented an electric furnace for producing high grade steel. The invention is the result of 35 years of research and, it is claimed, will revolutionise the world's steel industry. An endeavour is to be made to form a Company at Vancouver and to construct a steel plant, based on the invention, that will have an initial output of £500,000 worth of steel per annum. The company would obtain their supplies of raw material from the extensive deposits of magnetite iron ore that are found in British Columbia. These deposits have up to the present been considered useless for steel manufacture and their utilisation would find employment for a considerable number of men.



An unusual view from below of one of the " creeper " cranes mounted on the abutment towers of the Sydney Harbour Bridge.
(See page 622)

Huge Concrete Chimneys in Canada

The International Nickel Co. are constructing at Copper Cliff, Ontario, Canada, a reinforced concrete chimney that will be the tallest of its kind on the American continent. This chimney will be approximately 600 ft. in height and have a mean diameter of 50 ft.

The distinction that will be achieved by this chimney is at present held by the reinforced chimney at the plant of the Horne Copper Corporation, Norando, Quebec Province. This chimney was erected in 1927, and is 422 ft. in height from the base to the top of the shaft, while the internal diameter at the top is 18 ft. The reinforced concrete ring forming the base of the chimney is no less than 17 ft. 6 ins. in depth, 23 ft. inside diameter and is 6 ft. in thickness. It was designed specially to withstand the effects of acidic gases passing up the shaft.

Zuyder Zee Reclamation Scheme

Work is now proceeding on the reclamation of the Zuyder Zee in Holland. As most of our readers will be aware, the Zuyder Zee was originally a lake, but great inundations during the 13th century caused it to become a gulf of the North Sea. It covers an area of 2,027 sq. miles, its maximum length is 85 miles, and its greatest breadth 45 miles. The average depth is about 11.5 ft.

Owing to the urgent need for new land for farming and residential purposes the Dutch Government decided some time ago to drain this vast area. It is estimated that the land reclaimed will provide homes for at least 400,000 people. When the work is finished, a small portion of the Zuyder Zee will remain, but it will be nothing more than an artificial lake with an area of 280,000 acres, while Marken, an island whose inhabitants have hitherto specialised in fishing, will become a typical Dutch inland village, 45 miles from the sea.

In order to keep out the waters of the North Sea the construction of a huge dyke 21 miles in length is necessitated. When completed this dyke will be the largest of its kind in existence. It will carry a railway line on the top and will be 300 ft. in width at the base. There will be two sets of locks incorporated in the dam capable of admitting vessels with a tonnage of up to 2,000, while the passage of the River Yssel will necessitate the construction of 30 sluices. The whole scheme will cost over £40,000,000 to carry out, but it is estimated that the value of the reclaimed land to the Government will be at least £45,000,000.

A serious question that the drainage scheme is raising is that of finding employment for the men who have hitherto been engaged in fishing from the villages along the shores of the Zuyder Zee, and it has been stated that they will be offered work on board new whaling vessels that will operate from Dutch seaports.

New Grain Discharging Plant for Liverpool

In support of the claim that Liverpool is the greatest grain discharging port in Europe, it was stated recently that whereas 3,000 tons of grain are discharged each day in Hamburg, the total tonnage in Liverpool for each day of eight hours is 4,000. A Liverpool company have announced that, in order to speed up the transfer of grain from steamer to warehouse, they intend to instal very shortly an entirely new plant capable of dealing with 500 tons per hour. This will consist of two pneumatic intake elevators and conveying vans, which will discharge and convey the grain from the steamer direct to the warehouse.

Swedish-Italian Telephone Line

The Swedish State Telephone and Telegraph Department has recently established telephone communication with Italy. The new telephone line is approximately 1,865 miles in length.

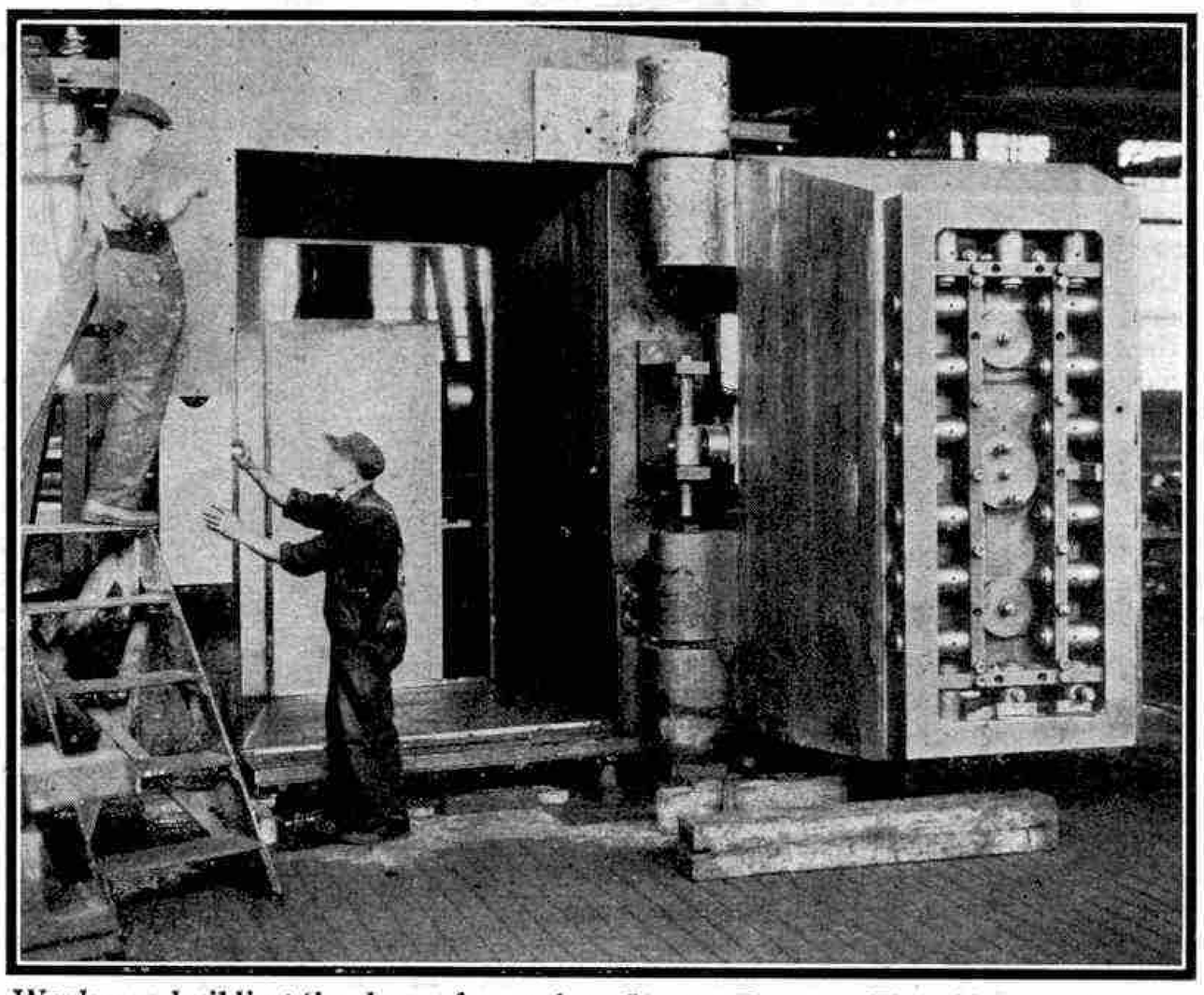
Mob-Proof Strong-Rooms

Vaults that Defy Thief, Fire, Floods or Bomb

By H. J. Shepstone, F.R.G.S.

IT is probable that the majority of people, if asked, would say that safes and strong-rooms are quite a modern institution. This is not the case, however, for strong-rooms of various types have been in use from very early times. The Pharaohs of Egypt, for instance, stored their treasure in chambers either hewn out of the solid rock or constructed of blocks of masonry of enormous size and weight. Treasure chambers of a somewhat similar nature were built by the monarchs of most Eastern peoples of that period.

As time went on these effective but cumbersome strong-rooms were improved upon. In the Middle Ages a favourite type of strong-room was the underground dungeon fitted with tremendously heavy doors secured by massive double bolts. These dungeons were used either for the protection of treasure or the safe-keeping of prisoners, as occasion demanded. As commerce developed, the necessity for more convenient types of strong-room became evident and gradually there was evolved the modern vault, which embodies every possible means of circumventing the burglar and for resisting the attacks of fire.



Workmen building the door of a modern Strong-Room. The photograph gives a good idea of the immense size and thickness of the structure

It is interesting to know also that such an apparently recent introduction as the safe-deposit had its counterpart in Roman times, for Professor Lanciani, in one of his books, quotes a Roman official advertisement for the letting for yearly periods of " strong-boxes and repositories," during the time of the Emperor Hadrian, 117-138 A.D. !

The modern safe-deposit originated in America, mainly as a result of the Civil War. During that period bank robberies became so frequent that the banks became alarmed, and finally refused to undertake the custody of their customers' valuables. One of these institutions referred its anxious clients to its porter as willing to accept the risk. For a small sum this man took charge of boxes and safes and made a fortune by so doing.

It was not long before this scheme suggested the establishment of safe deposits on a large scale. At first structures of quite an ordinary nature were built, through the windows of which the public could gaze at armed guards patrolling day and night the passages where the safes and strong-rooms were situated. Since that time the safe-deposit has undergone a series of important developments and to-day it may be said to represent the last word of science against fire and robbery.

Last year a very striking demonstration was provided of the enormous strength of a modern safe-deposit. A well-known American company were engaged to raze a vault in a bank in New York. This company had at their command all the tools, appliances and skilled labour required for the purpose but it took them some months to break up the structure. This is the first instance on record where it has taken many weeks longer to raze a vault than to erect it.

The exterior portions of the walls of this vault were of concrete reinforced with horizontal and vertical steel rods. These outer walls were intended almost entirely as a protection against fire because, contrary to popular belief, reinforced concrete can be cut by the ordinary cutting torch.

Inside this wall, and forming a metal component, was an underlining of " Ferrox " 6 in. in thickness. " Ferrox " is a product that has been on the market for some ten years and it was developed particularly for this purpose by manufacturers outside the vault-building industry. It was used originally as a protection against the electric arc and later with equal success against the cutter-burner. During recent years it has been improved upon very greatly as regards material and manufacture, and now it is capable of resisting the torch and fluxing rod and the oxygen pipe or lance. It consists of iron cast in large square slabs made tool-proof upon the outside face and carrying a core the greater part of its own thickness of large crystals of magnesium oxide, highly resistant to heat and produced in the electric furnaces at Niagara Falls under a fusing temperature of 8,000°F.

The easiest method of burglariously entering a lined vault is to pierce the lining with a torch and rod and continue cutting until a section large enough for a man to pass through is freed. This cut section is then pushed inwards into the vault and the burglar climbs in after it. In the case of this vault, however, there was an inside section that worked wonders.

Assuming that by certain means a man-hole section were cut in the " Ferrox " interlining, it is evident that

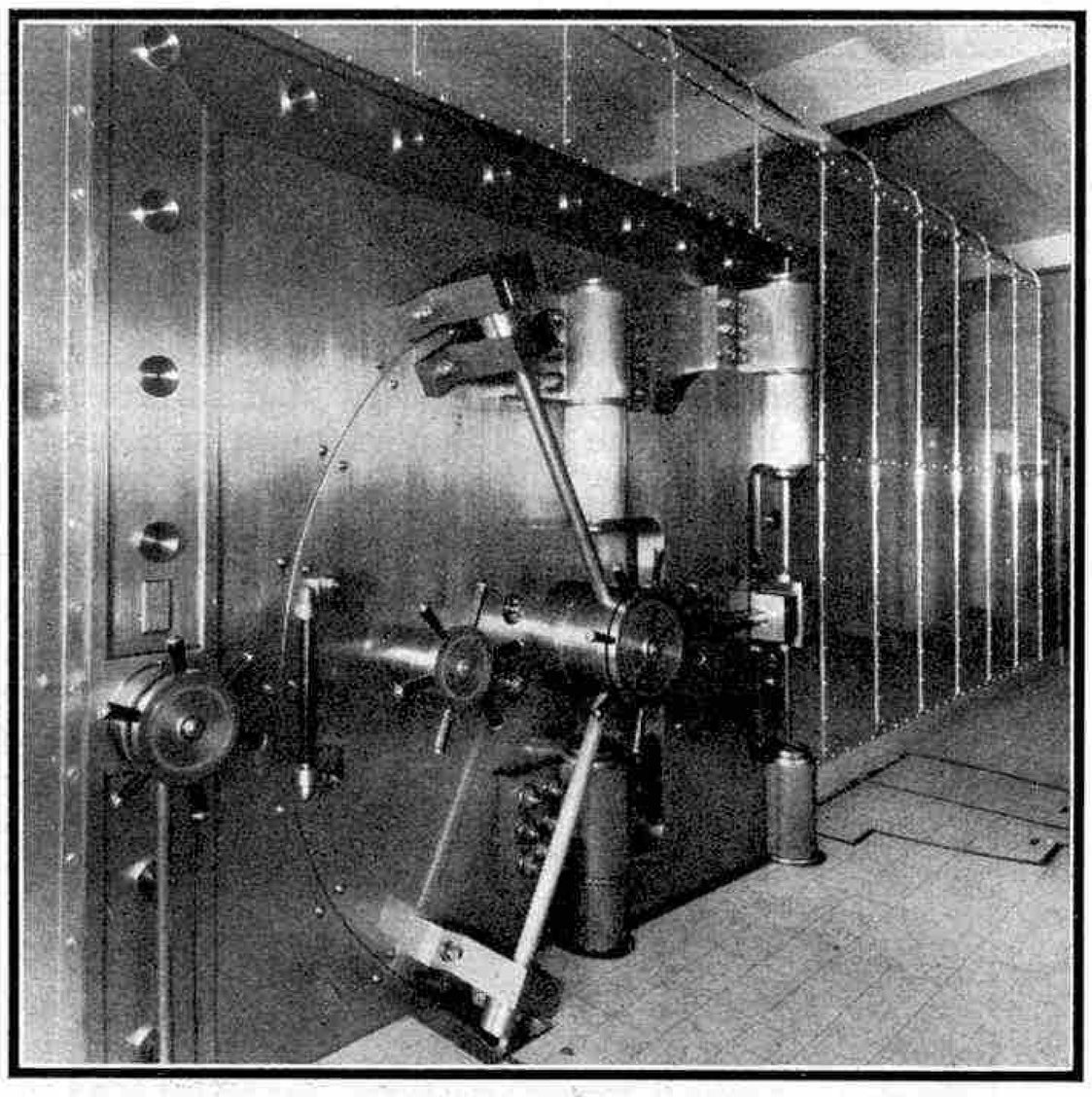
if a buttressing wall were provided inside the lining the loose section could not be pushed into the vault. Such a buttressing element was used in this vault for the first time. The idea was entirely new and was merely the product of a theory, but this theory appeared so clear and workable that it was considered to be a perfectly safe mechanical proposition. Seldom has any theory been more conclusively vindicated, for it was the power of "Ferrox" combined with the buttress wall that caused almost all the trouble in demolishing the vault.

The publicity given to this type of construction has resulted in a veritable epidemic of monster safe-deposits springing up throughout the United States. We have many wonderful institutions of this kind in England, especially in London, but they cannot compare in size with these latest giants across the Atlantic. The doors of some of these safe deposits weigh between 80 and 90 tons and vary in thickness from 36 in. to 50 in.!

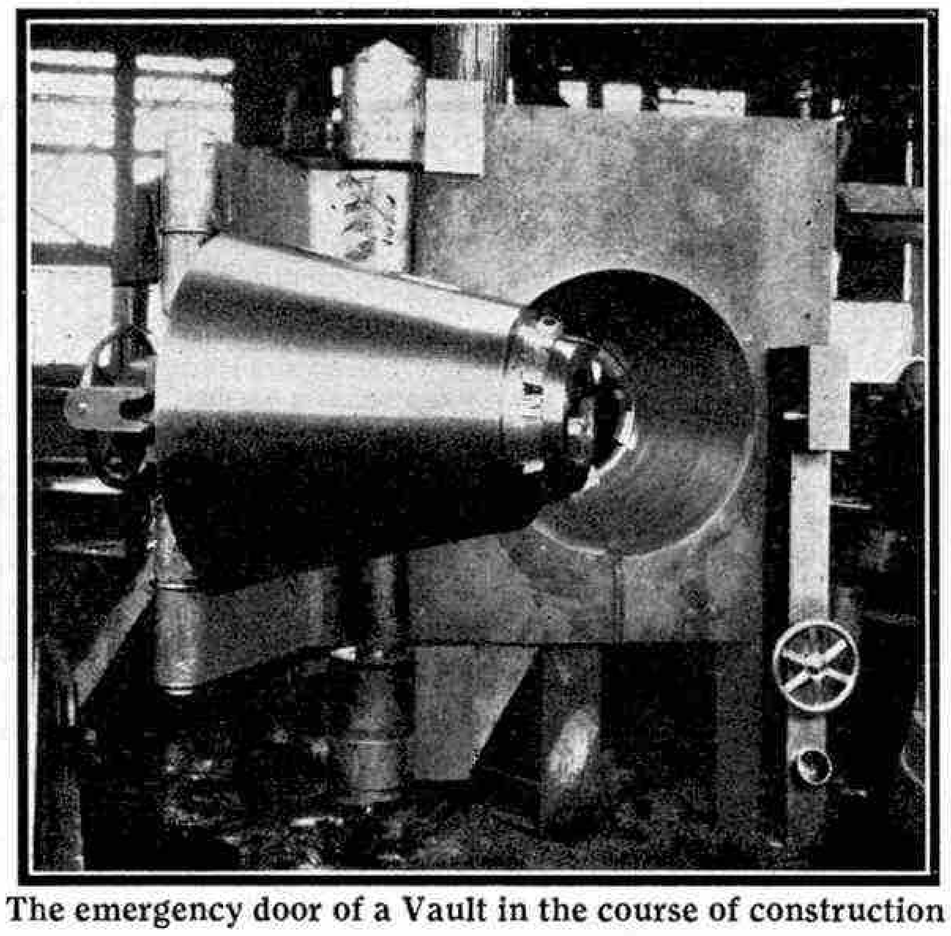
The safe-maker to-day aims not so much to make his vaults impregnable to the ordinary burglar as to make them proof against mob attack. The builders of the latest safe-deposits claim that if the authorities should lose control and mob rule be established their vaults would still be impregnable, for they cannot be opened even if explosives are rained upon them. They are able to withstand mob force, burglars' attack, flood and fire, earthquake, structural collapse, and even a possible bombardment by some attacking army.

A typical example of one of these marvellous structures has recently been installed in the Mellon National Bank, Pittsburgh. It forms a central feature of this great banking house, measuring inside approximately 10 ft. in height, 40 ft. in width, and 25 ft. in depth. It is equipped with a circular door having an overall thickness of 34 in. The safe-deposit boxes are of the very latest type and are of various sizes to suit the convenience of the bank's customers. They are all equipped with the latest style of interchangeable key locks. The bond-boxes or containers in these safe-deposit boxes are rather unusual, as they are built entirely of aluminium that has been polished and lacquered, and thus present a very attractive appearance.

The interior of this vault is finished throughout in polished steel with a handsome steel-panelled ceiling and appropriate lighting devices. The vault is airtight when the door is closed but there are exhaust fans to keep it thoroughly well ventilated when the door is open.



Exterior view of massive steel Safe Deposit Vault in the new building of the Mellon National Bank of Pittsburgh, U.S.A.



The emergency door of a Vault in the course of construction

The oldest safe-deposit in this country is that known as the National Safe Deposit situated in Queen Victoria Street, London. Here are to be found 32 great armour-plate vaults built up in four tiers, which can claim the distinction of being fire-proof, water-proof, burglar-proof, and bomb-proof. The outer walls are 13 ft. in thickness. Then comes a passage and thick walls again, lined inside with armour-plate dovetailed in sections and strengthened by rod iron framing. The colossal doors leading to the vaults possess no locks and are opened and closed by hydraulic power. At night, after the machinery that operates these doors has fulfilled its duty, it is disconnected, and if burglars were to attempt to reconnect it they would release the water in a cistern above the vaults, which would mean that the whole place would be flooded and the burglars, being unable to escape, would be drowned like rats in a trap.

The largest safe-deposit in this country is that at Chancery Lane, London. This is a veritable nest of strong-rooms and safes, totalling in all some 40,000 receptacles. Some idea of its popularity may be obtained from the fact that since it was opened it has been obliged to enlarge its area some four or five times. It is used a great deal by the diamond merchants in the district and it is a common thing for a broker to rush down the broad white steps leading to the vaults, just before closing time, with £20,000 worth of diamonds in his pockets!

It was at this deposit that time-locks were first used in this country. Now all modern safe-deposits possess them. These timepieces operate for periods of from one hour to three days. When the doors are closed the timepiece is set and it is then impossible for the doors to be re-opened until the clock has run its allotted time. An involuntary demonstration of the efficiency of the arrangement was provided a short time ago at a well-known safe-deposit. The clerk whose duty it was to look after the timepiece inadvertently over-wound it, with the result that the renters could not gain access to their safes until late in the afternoon!

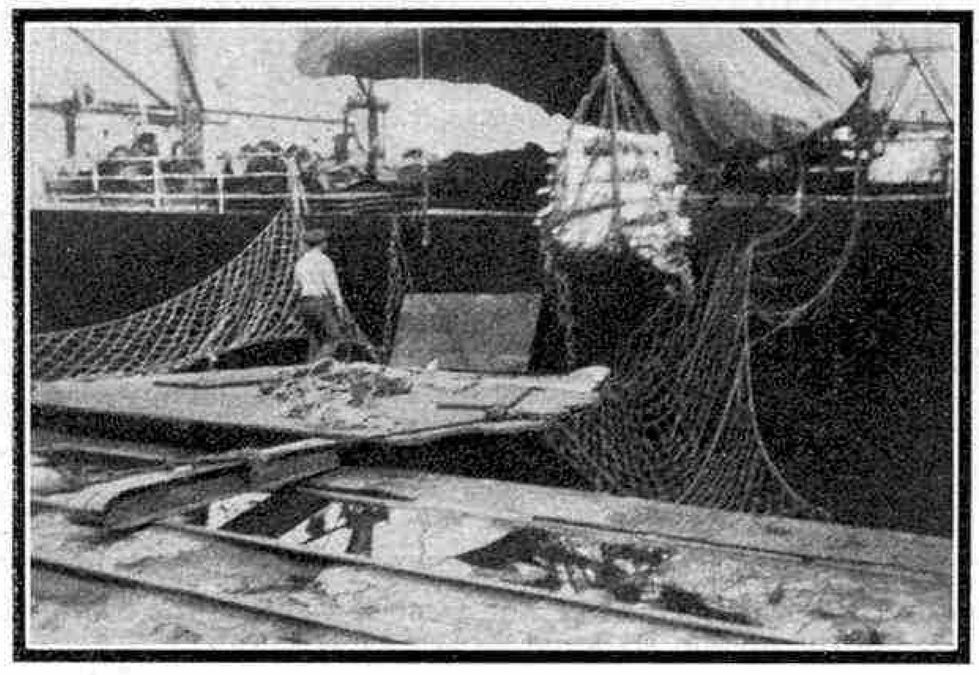
FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Voyage in a Meat Carrier

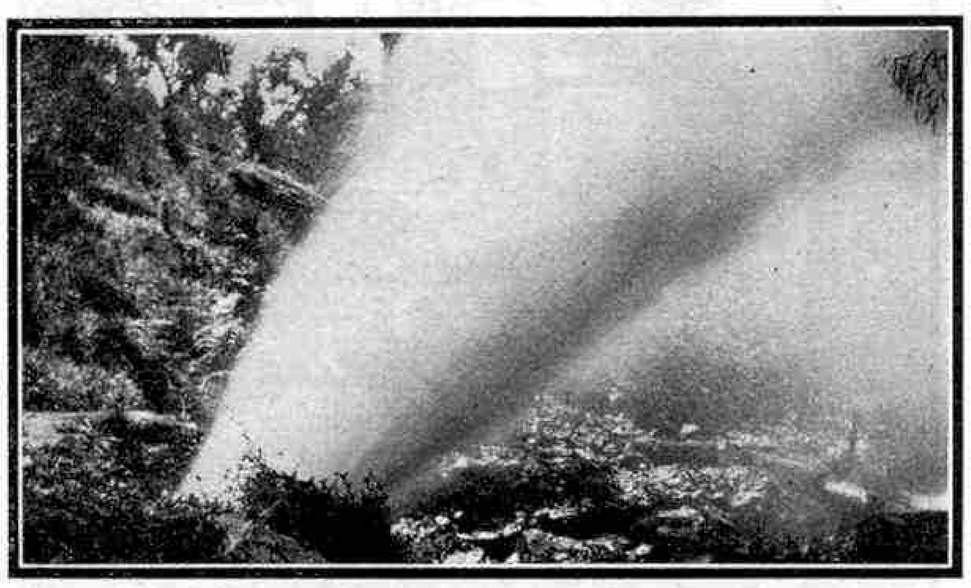
Recently I had the pleasure of making a voyage to South America and back in one of the meat-carrying vessels of the Donaldson-South American line. The voyage across the Atlantic Ocean was exceedingly enjoyable and the preparations made for the reception of the cargo added greatly to its interest.

On arrival at Buenos Aires the outward cargo was discharged and the holds were carefully washed and prepared for the storage of beef. When this operation had been completed to the satisfaction of Government inspectors, the temperature of the rooms was lowered almost to freezing point, and the vessel was taken alongside an enormous "*frigorifico*," or factory in which cattle are slaughtered and the meat dressed and chilled ready for export.



A sling of mutton being taken on board a refrigerating ship at Buenos Aires

As we approached the factory two long trains of cattle trucks came to a standstill in the railway sidings, and the cattle they had brought forward were removed to a compound in which they rested before being slaughtered. I was astonished at the excellent fittings of the cattle trucks, all of which are of the corridor type and have doors at each end to enable the cattle to be driven right through the train. The animals were remarkably healthy in general appearance and condition, and before leaving the Argentine I found that a most careful watch for any sign of disease is kept, all cattle imported being detained in quarantine for about a month, while diseased meat is immediately destroyed in order to prevent its being exported.



A wonderful waterspout! The water comes from the penstocks of one of a group of hydro-electric power stations in Victoria, Australia

The loading of the meat was a very interesting process, a constant stream of quarters of beef passing along mechanical carriers from the cooling chambers in the frigorificos to the vessel. As each hold was filled, its hatches and doors were closed, and during the voyage it remained sealed. The responsibility for delivering the beef in good condition rests on the engineering staff of the vessel, and care is taken not to allow the temperature inside the chilled rooms to vary by more than half a degree. On arrival in London I was able to see for myself that the meat had the same splendidly fresh appearance that it had when shipped at Buenos Aires. J. M. SWANSON (Glasgow).

How Asphalt Roads are Made

The most important material in the construction of a modern road surface is asphalt, a bituminous substance that is found in a natural state in various parts of the world. The best known source is the famous Asphalt Lake in Trinidad, where the bitumen comes up in the form of a thick liquid. When set, it has the appearance of solid pitch and may be dug out, fresh asphalt then filling up the holes made. There are similar lakes in Mexico and parts of South America.

In the process of preparing a road surface, the asphalt is mixed with sand, cement, and clean stone chippings, the cement being used as a filler and not for its setting qualities. The mixture is heated to a temperature of 360°F., and is spread over the surface of the road. It is then rolled and is ready for use as soon as it has cooled. In many cases existing roads are torn up, and a layer of stones coated with bitumen is rolled in before the new surface is made.

In certain parts of Europe a substance known as rock asphalt is quarried. This is limestone that has been naturally impregnated with bitumen, and it forms a part of a mixture called "mastic asphalt" that is often used in road-making. It sets more slowly than the usual asphalt coating, but gives a road surface that is equally durable, dustless, and silent.

F. MASON (Swansea).

An Artificial Waterspout

Some friends and I spent a recent holiday in a tour of the country behind Melbourne, and two days after leaving our homes in Geelong we camped amid the gorgeous mountain and river scenery that surrounds the town of Eildon. There we were chiefly interested in the Eildon Weir, an enormous embankment in the construction of which it was necessary to blast away almost half a small mountain. At the time of our visit the work was incomplete, and men were busily engaged concreting the outer face of the dam. This was being given an appearance similar to the side of one of the Pyramids, by the construction on its slopes of giant steps over which the flood waters of the reservoir will flow.

We climbed to the top of the embankment and saw beyond it an immense sheet of water stretching away into the distant hills. Eildon Weir is only a part of a gigantic hydro-electric scheme that will be brought into operation very shortly, the plant below the dam being one of five that are under construction. After a thorough look round we set out for a second station called the Rubicon Works, which is situated about 24 miles from Eildon Weir.

On our journey we saw high-tension cables crossing the country in all directions to link up the five stations, three of which we passed on the way to the Rubicon plant. Presently we struck a small wagon-way used for transporting material, and although in places there was barely room for a wagon between the cliff face and the edge of the precipice overhanging the valley, we decided to ignore the risk of meeting a train on the way and followed the line.

As we approached the works we heard a tremendous roar for which we could not account. The noise grew louder and louder until, as we rounded a bend in the road, it suddenly became absolutely thunderous. But now the mystery was solved, for the noise was due to a gigantic waterspout that roared out from a pipe 3 ft. in diameter. We discovered later that this came from the Rubicon Works. When the water brought down from the dam in the distant hills has passed through the penstocks of the plant it is brought to this spot through underground conduits in order that it may be discharged without doing any damage.

L. J. B. BLAKE (Geelong, Australia).



Pitcairn Islanders singing hymns as a liner leaves their coast

A Glimpse of Pitcairn Island

During a recent voyage to England I had an opportunity of seeing Pitcairn Island, a lonely island in the Pacific Ocean. A few years ago this historic island was almost isolated, its inhabitants receiving visitors from other parts of the world only about once in three months. To-day they are more fortunate, for vessels of a line that plies between Southampton and Wellington, New Zealand, call once a fortnight.

When I first caught sight of the island it had the appearance of just a huge rock, but as we drew nearer I could see that it was rich in vegetation. The cliffs on the side on which we approached are very steep, but a short strip of sandy beach makes a good landing place for small boats.

We anchored about half a mile from the island, and immediately almost the entire population came out in their whaleboats, bringing with them bags of fruit and curios that they offered for sale. The people were barefooted and I was interested to notice that the women climbed the side of the vessel by means of rope ladders as quickly and easily as the men. The next two hours were spent in talking and bargaining with these people, to whom the visit of a boat is a great event.

The original islanders were mutineers from the British warship "*Bounty*," who were goaded into rebellion by the severity of Lieut. Bligh, the commander of the vessel, when she was engaged in a cruise in the Pacific Ocean in 1792. After setting him adrift they made for Tahiti. There some remained, but the more determined spirits set sail for Pitcairn Island, taking with them Tahitian women whom they had married.

The present inhabitants of the island are descendants of one of the mutineers, and seem quite contented on their island home. A few years ago the population had increased so largely that a number of the younger men and women left to seek fortune in other lands, but with few exceptions they have since returned home.

When the two hours were up the islanders returned to their boats and the ship slowly steamed away, the islanders singing hymns as we left them behind.

V. ALFORD (Melbourne).



Typical inhabitants of Pitcairn Island

Experimental Mine at Buxton

After reading the account on page 459 of the June issue of the "*M.M.*" of the manner in which fires in mines are extinguished, I went to see how work was progressing on the Experimental Mine Station that has been built on the moors behind Buxton. Until recently mine workings were represented by large iron tubes, in which coal dust explosions were deliberately produced and the terrific speed with which these travelled was measured electrically. Unfortunately on several occasions the tubes have burst and for this reason they have been replaced by a tunnel bored through a small hill. This is far more like a mine gallery than was the old iron tube.

The tunnel is semi-circular in cross section and is 700 feet in length. It has been blasted through almost solid limestone and strengthened by massive semi-circular bands of iron. For greater security concrete has been grafted into the fissures in the rock outside the iron bands. Heavy counterbalanced steel doors close the gallery when the coal dust is fired. A light railway running throughout the length of the tunnel is used for supplying the coal dust.

H. N. BEADLE (Buxton).



Vienna as an Air Line Centre

Although it is only two years since the Austrian Air Traffic Association Ltd. received its first subsidy, Vienna now ranks as one of the most important centres of air traffic in Europe. Its geographical position on the edge of the great Hungarian plain is ideal, and at the present time no fewer than 14 important routes converge on the city, important and well-patronised services being maintained between Vienna and Berlin, Munich, Bucharest, Constantinople, Danzig, Copenhagen, London, Geneva and Rome, among other cities.

The development of aviation in Austria has been the work of only about six years. In 1923 the number of flights made by the six aeroplanes then constituting the fleet was 1,597, and 2,390 passengers were transported. Four years later the number of passengers had increased to 15,740 and more recent developments have been on an even larger scale.

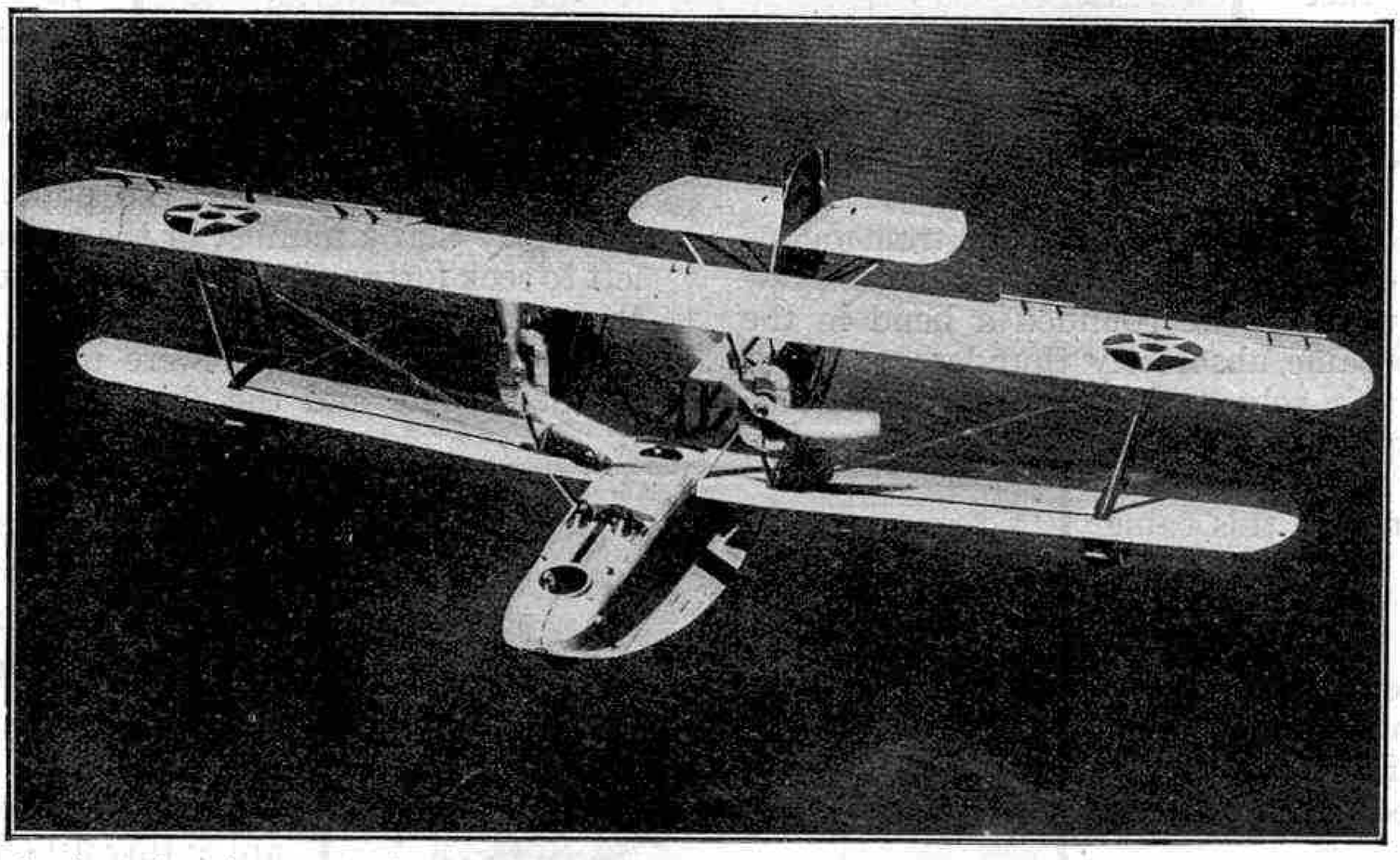
Several of the air lines routing from Vienna pass over the snow-clad summits of the mountains of Tyrol and of Switzerland, and the flights between Vienna on the one hand, and Venice, Salzburg and Zurich on the other, are among the most wonderful in the world from a scenic point of view.

An Aircraft Technical School

The De Havilland Aircraft Company have established at their works a school where private owners, aircraft students, and engineers can study the technical side of aviation. Those attending the school have the choice of six courses of study, ranging from a one-week course of general instruction in aircraft and engine maintenance to a course extending over two years and embracing all branches of technical instruction in aviation. The school is under the leadership of A. T. Eadon who was one of the founders of the Institute of Aeronautical Engineers.

A New Endurance Record

On May 26th an interesting record was made at Fort Worth, Texas, by two American airmen named R. Robins and J. Kelly. Mr. Robins was formerly a railway mechanic and his partner is an ex-cowboy, who had only qualified as a pilot six weeks previous to the attempt, but they succeeded in maintaining the flight for 172 hrs. 32 mins. This remarkable flight of more than a week was made in a second-hand monoplane of unknown make, rebuilt by themselves, the engine of which had already done 50,000 miles flying. During this flight re-fuelling was carried out no less than 15 times. It speaks well for the possibilities of flying when an old machine in the hands of comparatively inexperienced pilots can set up such a wonderful record with a minimum of preliminary organisation and attention.



A giant American aeroplane constructed for carrying out naval operations. This machine is equipped with two Packard motors of 600 h.p. and carries a crew of five men, three machine guns, and 300 k.g. of bombs

United States Air Estimates

The United States estimates for 1929 include provision for the addition of no fewer than 710 aeroplanes to the aerial sections of the Army and Navy. Of these the army will receive 410, the construction programme involving the building of 120 new training aeroplanes, 142 observation machines and 88 pursuing machines. In addition 37 bombers and 15 freight carriers are to be built.

15,000-Mile Flight by French Pilots

Two French pilots, M. Bailly and M. Reginensi, flying a Farman machine fitted with a "Bristol" Titan engine, have completed a successful return flight between Paris and Saigon in Cochin-China, the approximate total distance flown being 15,000 miles. The outward journey was made in 10 days, occupying 90 flying hours; while the return journey took nine days, being made in 85 flying hours. Landings were made on both journeys at Constantinople, Baghdad, Karachi and Bangkok.

On the outward journey a severe sandstorm was met with, which compelled a landing to be made at a point 12 miles from Basra. Progress was also very difficult in Persia and very hot conditions were encountered in India; but in spite of all this an average speed of 93 miles an hour was maintained. When it is considered that the machine on which the flight was made may be classed within the category of a light aeroplane, and that a single engine was fitted, the high standard of reliability shown throughout the flight is commendable.

French Atlantic Flight

Three French airmen, Lieut. Lefèvre, Sergt. A. Assolant and M. Lotti, recently landed at Comillas, near Santander, Spain, after having flown across the Atlantic Ocean from Old Orchard, Maine, in their machine, the "*Yellow Bird.*" The trans-Atlantic flight was made in spite of bad weather conditions, a violent storm occurring during the crossing. It was the original intention of the aviators not to land until Paris was reached, but unfortunately an unscrupulous stowaway, who might have caused the machine to crash in mid-Atlantic, was discovered after leaving the American coast, and the landing in Spain was necessitated by the shortage of petrol and supplies. The airmen later flew to Le Bourget, France.

Australian Air Mail Service

A very valuable extension of air mail service in Australia has been instituted, a weekly service having been established between Perth and Adelaide. This is being run in connection with the arrival at Freemantle of vessels carrying mails from Great Britain, and the first despatch to be transported over the new route left London on 9th May last. The saving of time is very considerable, for letters to Melbourne arrive four days earlier than would be the case if sent in the usual manner, while three days are saved with letters for Sydney.

Solo Flight Round Australia

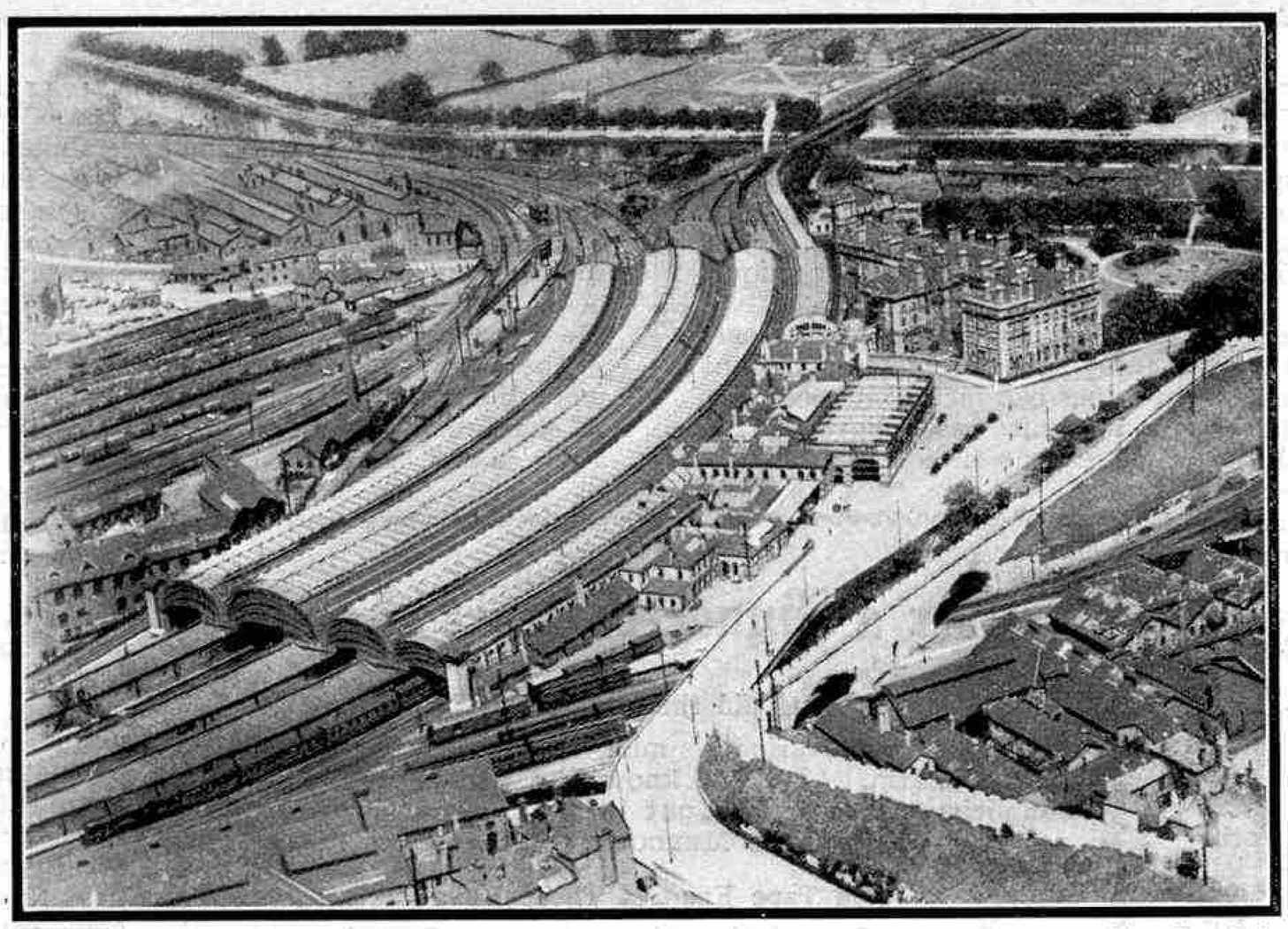
A solo flight round Australia was completed a short time ago by Captain the Hon. Hugh Grosvenor, A.D.C. to the Governor of South Australia, Brigadier-General the Hon. Sir Alexander Hore Ruthven.

Captain Grosvenor took approximately 30 days on his record-making 8,000-mile solo flight, but when at Port Darwin, he delayed his flight in order to take part in the search for Flight-Lieutenant Moir and Flying Officer Owen. A unique feature of the flight is that no trouble of any kind was experienced and that at no time was the pilot in any great danger.

British Aircraft Predominate in Australia

Of the 121 aircraft registered in Australia up to the end of last year, no fewer than 103 were of British origin, thus showing that, in regard to aeroplanes at least, Australians are following the advice to "Buy Empire Products." Half of the total number of British aeroplanes was made up of light aeroplanes, and of these the majority were "Moths," with "Avro-Avians" in second place.

Stations from the Air: No. 3



Photo] [*Aerofilms Ltd.*

The great sweeping curve of York Station is excellently revealed by this aerial view. The northern end of the up main platform, 1,692 ft. in length and the longest in the country, can be seen jutting out from beneath the two centre roof spans

Neunhofer's Altitude Record

In our last issue we stated that the German airman Neunhofer had established an altitude record of 40,625 ft. Since then the sealed barographs carried in the machine have been opened, and official figures give the height attained as 12,739 metres, or approximately 41,790 ft. This height has been recognised by the German official testing station, and it is anticipated that in due course it will be accepted as a world's record.

The machine was a Junkers W.34, not a W.33 as we were originally informed; and its weight when fully loaded was approximately 2,820 lb. A height of 32,800 ft. was attained in 30 minutes, and the maximum, 41,790 ft., in 74 minutes.

Sky Speaking in Australia

Certain enterprising advertisers in Australia have enlisted the service of an aeroplane fitted with a wireless loud-speaker. The machine is flown at a height of a few hundred feet, and the pilot announcer shouts his messages to the public. His voice has been heard up to a height of over 1,000 ft. This kind of advertising on an organised scale would be a serious annoyance, and it is to be hoped that it will not be encouraged.

Pick-up Apparatus for the "*Leviathan*"

The pick-up device described in our March issue, which enables an aeroplane to collect and deliver mails without landing, has been fitted on board the S.S. "*Leviathan*." As our readers will remember, the apparatus consists of a trap closely resembling the bow section of a boat. The trap on the "*Leviathan*" is 60 ft. in width at its mouth and 35 ft. in depth. The cable that is suspended from the aeroplane, and to which is attached the little knob that is caught in the trap and thereby releases the mails, is 150 ft. in length. The first test of the "*Leviathan*" apparatus was made during June in mid-ocean, 600 miles west of New York, and it proved to be quite successful. The inventor of the apparatus states that traps of a similar nature have been installed and are giving satisfactory service on a regularly operated air line between Cleveland and Pittsburgh, in the United States. It is interesting to note that the new North German Lloyd liner "*Bremen*" carries an aeroplane and a catapult. The aeroplane pilot on board the ship is supplied by the Deutsche Luft Hansa and is responsible for the care of the machine.

American machines numbered only 10; and of the others, five were French, two German, and one Dutch. The Dutch machine registered was the famous "*Southern Cross*," in which Captain Kingsford Smith and his companions made their historic flights across the Pacific Ocean. The history of this aeroplane is full of interest. It was built from the remains of two Fokker aeroplanes that crashed in Alaska while being flown on Sir Hubert Wilkins' first Polar expedition by air. After a second flight to New Zealand and back again to Sydney, Capt. Kingsford Smith with three companions set out on what he hoped would be a record-breaking flight from Australia to Great Britain, but unfortunately the flight came to an end when the machine was forced down in an isolated district in northern Australia. Search parties were organised, but more than a week elapsed before the "*Southern Cross*" and its crew were located.

Aircraft Carriers to Replace "*Lexington*" and "*Saratoga*"

We stated in our April issue that the Naval department of the United States had decided to replace their two giant aircraft carriers, "*Lexington*" and "*Saratoga*," by smaller vessels. Plans for the new vessels are already being prepared, and it is stated that one of the new carriers is to displace only 13,800 tons as compared with the 33,000 tons of the vessels that are to be scrapped. It will be capable of housing a normal total of 72 aircraft, but a maximum of 100 machines will be able to be accommodated under special conditions. Speed is being sacrificed to aeroplane capacity, and large guns will not, as previously, be included in the armament, which will consist only of comparatively light anti-aircraft guns.

England-India Air Mail

Statistics now available respecting the first three months' operation of the Imperial Airways England-India Air Service, show that during this period twelve double journeys were accomplished. A total of 4,700 lb. of mail was carried on the outward journey, and no less than 7,300 lb. of mail on the corresponding return trips.

THIS MONTH'S AIR STORY

"I think aeroplanes are becoming more wonderful every day. I hear that the latest type is even equipped with an up-to-date kitchen."

"Yes, I know a man who's been in one, and he says that when the cook wants to toss a pancake he just tells the pilot to loop the loop!"



Of General Interest

A Black Opal Worth £10,000

Many readers will be interested to learn of the reported arrival in England of a record specimen of black opal. The stone was dug out of the earth in one of the Australian opal fields, and is 2½ in. in length. It weighs 232 carats, and its exceptional size and the abundance and variety of colour it displays make it unique. Its value is estimated at £10,000.

Popular superstition regards the opal as an unlucky stone, but that does not prevent it from enjoying a considerable amount of favour. The belief that the opal brings bad luck to its possessor dates only from the Middle Ages, when it was believed to be responsible for a great plague. Before that time it was highly prized, and the discovery in Australia of the greatly admired black variety has led to a revival. A good black opal is one of the most remarkable precious stones in modern jewellery. It displays the most vivid colours; at one moment it may appear absolutely black, but a slight chance movement gives it a vivid crimson glow.

The opal differs from other gems in being a solidified jelly instead of a crystal. Slight cracks that opened in the jelly during cooling were filled with thin films of foreign matter. These act like thin soap films, the wonderful colours of which will be familiar to all readers, and give a wonderful opalescence to the gem.

Pure opal is colourless, but most specimens are tinted various dull shades. Black opals are generally dark grey or blue in colour, and owe the deepness of their tones to the presence of iron. They are found only in Australia, where two very productive fields exist. Since 1890 the total value of the gems unearthed from these fields has been estimated at more than a million and a half pounds, and this figure does not include the prices obtained for splendid pieces that have been found and sold privately.

Over a Hundred Years Ago!

What did the Farmer say?

"A lad, on delivering his milk, was asked why the milk was so warm. 'I don't know,' he replied with much simplicity, 'unless they put in warm water instead of cold.' "—"LIVERPOOL MERCURY," 14th September, 1827.

Red Tape Even in Those Days!

"The opening of the Gloucester and Berkeley ship canal, which was commenced in 1792, took place on Thursday last. In the process of forming this canal, it has been necessary to apply for six Acts of Parliament."—"THE TIMES," 1st May, 1827.

Award of Merit

"The two gold medals, value fifty guineas each, annually bestowed by the Royal Society of Literature on the authors of 'works of merit,' have been awarded to Sir Walter Scott and Mr. Southey."—"LIVERPOOL MERCURY," 4th May, 1827.

High Pay?

"Seamen are now so scarce in this port that several shipowners were compelled on Saturday last to give not less than £3/10/- per month for able-bodied seamen."—"LIVERPOOL ALBION," 1st May, 1827.

The "Busy Bee" a Lazy Creature!

Every now and then some serious-minded scientist steps aside from the study of great problems and, in the most callous manner, destroys illusions that have been cherished for ages. An American professor became suspicious that the bee, the insect that has always been held up as a shining example of industry, was a bit of an impostor! For 15 years he kept track of the comings and goings of bees, and now he has announced that they are a set of confirmed loafers! The old story books and verses have always led us to believe that from morning to night the bee never ceases in its search for honey. Now we are informed that the insect makes only from six to ten journeys a day, and spends the rest of its time in idleness! Fortunately there still is a possibility that bees will become worthy of their reputation, for the professor has begun to train a colony of the insects to work!

Chinese Printers' Heavy Task

A printing firm in Shanghai have almost completed the enormous task of making a complete set of types for use in Chinese printing. Many readers will know that Chinese symbols are not letters, but represent whole ideas, and they are numbered in thousands. As many as 10,000 of them may be printed with the types now being made, and as there are to be five different sizes of each, the complete number of types will be 50,000.

The work of a compositor using these types will be vastly more difficult than that of an English printer. The latter handles 26 characters, together with the necessary numerals and punctuation marks, and the compartments in his cases number 151. Imagine the task of a Chinese compositor confronted with the cases necessary to hold 50,000 types! Merely to walk from one end of them to the other would be quite a considerable journey, and more time would be spent in moving about than in actual composing.

Another way of realising the complexity of printing in Chinese is to try to imagine a Monotype for that language. The matrix used for English type on this composing machine contains 225 sections. This seems excessive for a language in which only 26 characters appear in the alphabet, but if a Chinese matrix case were proportioned similarly to the number of characters to be represented, it would be necessary to have nearly 100,000 matrices engraved on it! Fortunately for the peace of mind of future Chinese compositors, a standard written language is now being devised in which a very much smaller number of characters than are now in use will be necessary.

Gardens in the Sahara Desert

The Sahara desert was once the site of a great sea. Even to-day many of the fishes found in water holes in the midst of the desert are of exactly the same type as those living in the Nile and other African rivers, although there is no known connection with these waterways. It now seems possible that, in some parts of the desert at least, the old conditions may be easily restored; for an American engineer has proposed to flood an area of 47,000 square miles with water from the Mediterranean Sea. The suggested inland sea would occupy the site of a huge depression near the Gulf of Tunis, and great canals would be constructed to lead into it the necessary water.

If such a scheme could be carried out the effects would be very great indeed. The presence of a large expanse of water would attract rain to a district that has been dry for centuries and, from the Atlas Mountains, rivers would flow into the sea and irrigate the surrounding country. As the climate is now very favourable except for the absence of water, it would be possible to grow wheat, maize, cotton and sugar-cane practically all the year round, and this portion of the Sahara would be one of the gardens of the world.

Round the World in 23 Days

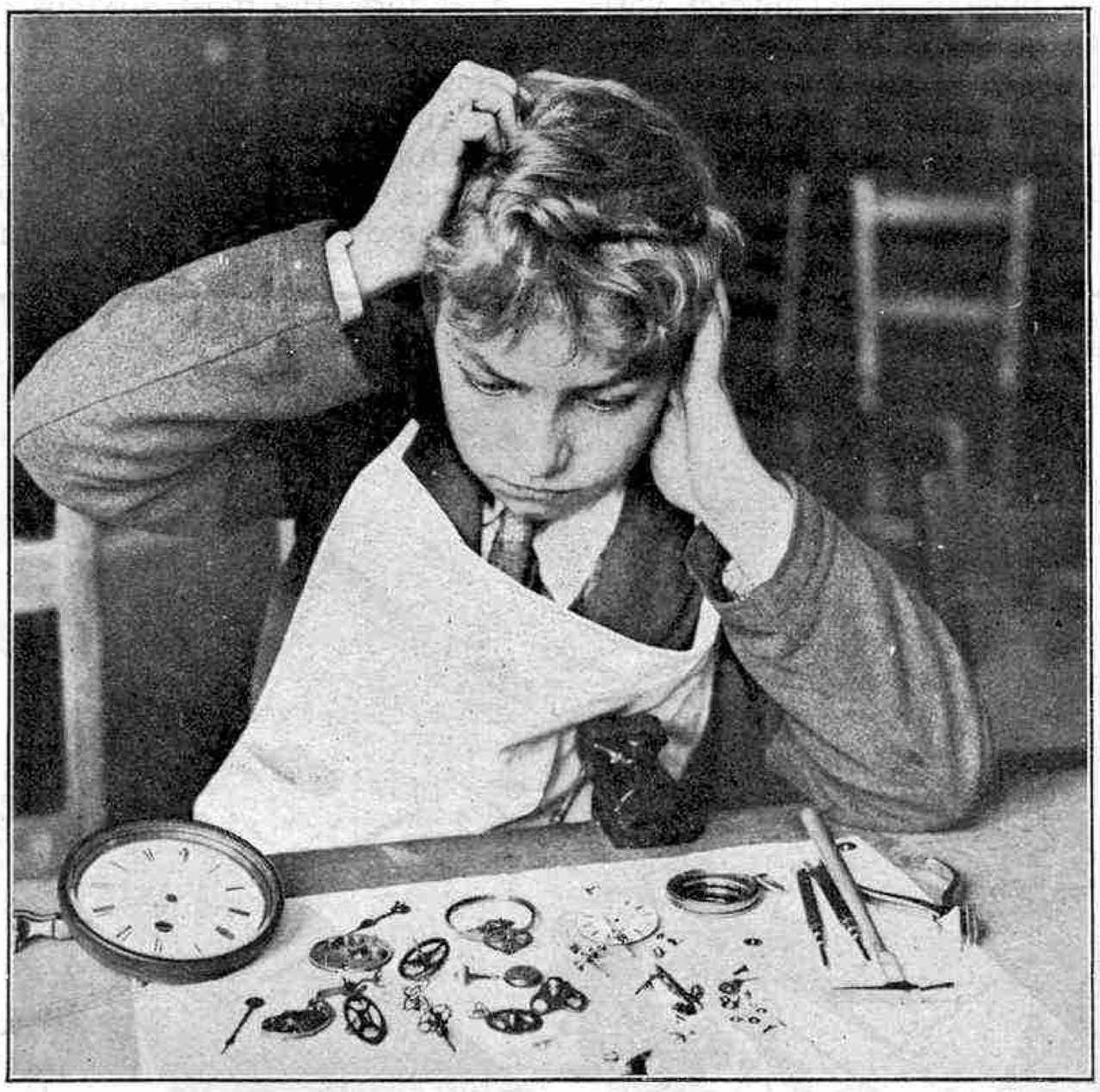
The journey round the world did not develop into a race until after the publication of Jules Verne's famous book, "*Around the World in Eighty Days.*" Many people believed that it was quite impossible to make the journey in so short a time as that taken by Phileas Fogg, the hero of Verne's story, and in 1889 an American woman named Nellie Bly decided to settle the dispute by a practical demonstration. Following almost the same route as that taken by Fogg, she reached her starting point 72 days after her departure, and thus vindicated the great French writer.

Faster trains and steamships and the introduction of aeroplanes have enabled this time to be reduced considerably. By 1913 it had been brought down to 39 days, and in that year J. H. Mears, an American, reduced it still further by three days.

The record stood at 36 days until three years ago, when Wills and Evans, also Americans, set out to break it. Twelve aeroplanes, three special trains, one motor car, several ocean liners and many small boats and vehicles were pressed into service, and the route round the south coast of Asia, followed in most previous attempts, was abandoned in favour of one across Siberia. The journey was completed by air, and the travellers arrived at their starting point near New York 28 days, 14 hours, 36 minutes and 5 seconds after their departure.

This feat aroused Mr. J. H. Mears to a further effort. Last year he and an airman named Captain Chas. Collyer set out with the ambition of being the first men to beat the Moon, which travels round the Earth in 27 days. Naturally the adventurers made great use of aircraft. They flew from New York in pursuit of the "*Olympic,*" which had left the city several hours earlier, and boarded the vessel off the outermost lightship. On the completion of the Atlantic crossing they continued their journey in a monoplane brought from New York on board the liner. Travelling by air when possible, and crossing the Pacific Ocean on the swiftest available vessel, they completed their journey in 23 days.

Thus in the last 40 years the record has been reduced by 49 days. It will be reduced still further when the whole journey can be made in the air, for an aeroplane with an average speed of only 100 miles per hour will take less than 11 days to encircle the Earth.



Despair ! The apprentice finds clock-repairing more difficult than he expected !

Predicting Volcanic Eruptions

In January of this year the director of the Volcano Observatory at Hawaii said that an eruption of one of the famous volcanoes of that island would take place during the present year. His prediction was quickly fulfilled, for before the end of February, Kilauea broke into eruption. The crater of this volcano is one of the most astonishing and interesting in the world, for it is no less than three miles in diameter. Through a long crack in its floor enormous fountains of lava spurted to a height of 200 ft. and in the short space of twelve hours a lake of molten rock 60 ft. in depth was formed.

A curious feature of this eruption was the formation on a large scale of what is called "Pele's hair." This is composed of glassy threads formed from lava by the action of the wind, which blows spray from the crests of the waves of molten rock into the air, where it cools quickly.

Predicting an outbreak of volcanic activity does not appear to be a particularly easy task. A long study of the volcanoes of Hawaii has shown that their eruptions have followed each other in cycles, and the prophecy that one would break out this year was based on this fact. This is not the only example of regular action below ground, for several hot springs and geysers are known to behave in a similar manner, although the intervals between their periods of activity are smaller. Perhaps the best known example is "*Old Faithful,*" the wonderful geyser in Yellowstone Park, the great national playground of the United States. This geyser spouts a column of boiling water 125 ft. in height at intervals of 65 minutes, and has earned its name by its great regularity.

In many cases geysers may be stirred into action by throwing stones into them, as this temporarily blocks the outlet and causes the pressure in the underground passages to increase. An interesting example is the "*Strokhr,*" a famous geyser in Iceland. Unlike most geysers, the "*Strokhr*" has no regular basin, and consists of a funnel-shaped tube that narrows down to a width of 10 in. at a depth of 27 ft. It may be caused to erupt at almost any time by throwing into it an appropriate quantity of turf and stones. Advantage was once taken of this to cook a dinner with its aid. The cook was a visitor named Commander Forbes, who first threw in a sufficient weight of stones and earth to ensure an eruption in 40 minutes. After this he dropped in a joint of mutton, wrapped in the body of a shirt, and two ptarmigan encased in the sleeves. The heat cooked both mutton and birds to a turn, and at the time appointed for dinner the eruption of the geyser threw out the shirt and its contents !

How Far Can We See?

Optical instruments have reached such a stage of perfection nowadays that if we wish to examine any very small object we do not strain our eyes but immediately seek the help of a magnifying glass or a microscope. Similarly we make use of a telescope when we wish to observe closely any object at a distance. The constant use of these optical aids is rather apt to make us forget the part played by the eye. For instance, few of us ever stop to think how far the human eye can see without any optical assistance of any kind.

Most of the long-distance naked eye records have been made either at sea or at great heights, and in conditions of unusually clear weather. Lights on the top of the mountains of Corsica are stated to have been seen from the northern coasts of France, the intervening distance being no less than 168 miles. An even more remarkable instance of long-distance vision comes from America, where lights reflected from mirrors on Mt. Shasta in California were seen from Mt. Helena, which is 192 miles away.

So far as is known, the latter distance is a record for vision on the Earth, but it does not by any means measure the limit for the human eye. Large numbers of stars that are easily visible to the naked eye are so far away that any attempt to express their distance in miles is quite hopeless on account of the enormous and unwieldy figures involved. A very much larger unit than the mile is required to express such distances, and astronomers have therefore invented a unit called the light-year, which is the distance that light travels in a year. This unit itself is nearly six million million miles, and our eyes are capable of seeing stars that are hundreds of light-years away !

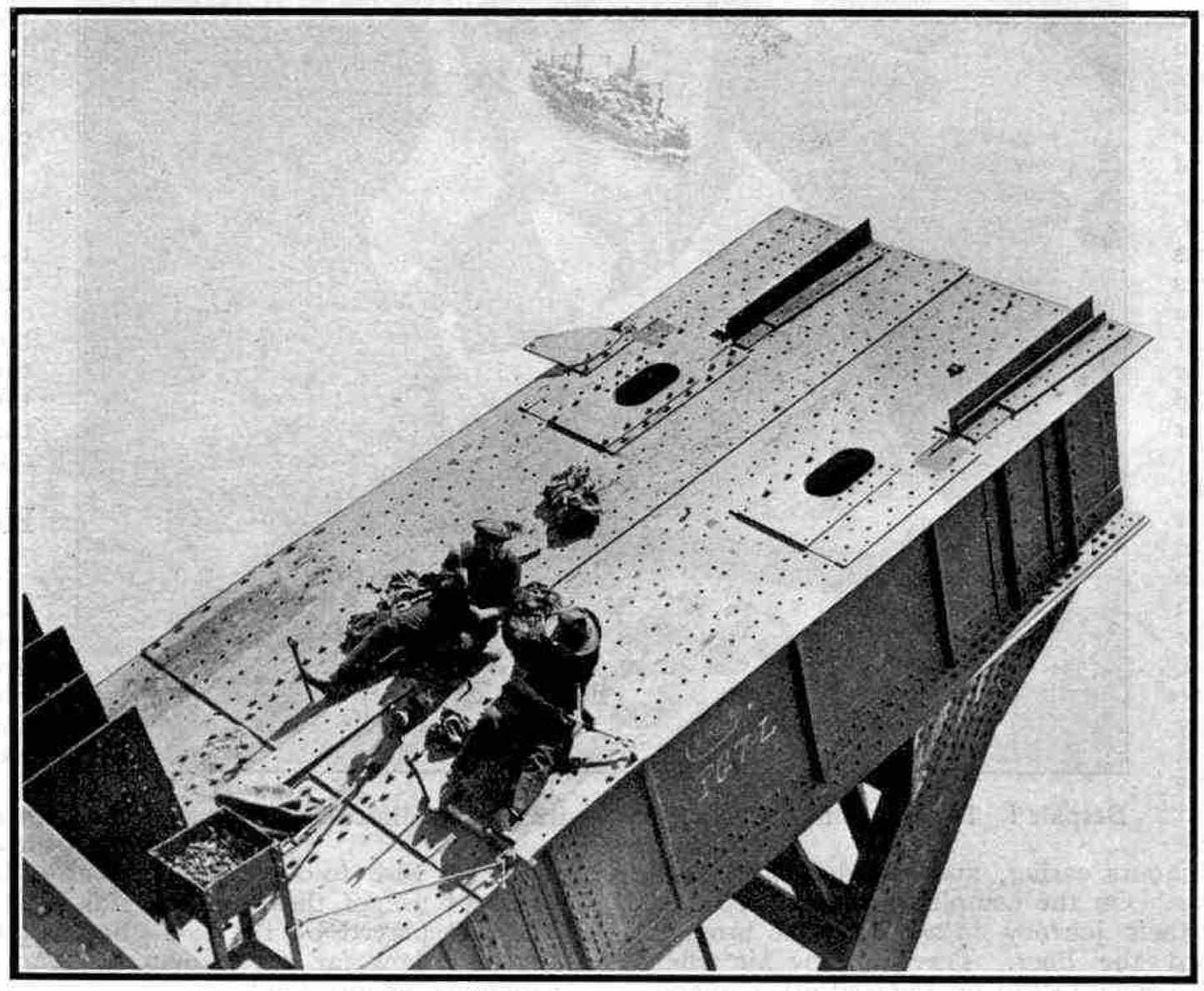
Millions of stars are so far away that they cannot be seen by the eye even with the aid of a telescope, and their presence has only been revealed by the use of the chemical eye that we call a photographic plate. To astronomers the latter is far more useful than the human eye, for the effect produced on it by a source of light easily may be increased by giving longer exposures. This has enabled astronomers to learn many lessons from stars that they have never seen !

Progress of Sydney Harbour Bridge

The Building of the Great Arch Commenced

IN the *"M.M."* for December 1926, and January and October 1927, we related the developments that had led up to the placing of a contract with the British firm of Dorman, Long & Co. Ltd., of Middlesbrough, for a huge bridge to cross Sydney Harbour. The design of the bridge was described in detail, and an account given of the preliminary work that was being undertaken prior to the commencement of actual construction. We are now able to give a brief account of the progress that has already been made, and of the enormous task that is now being commenced—that of building the huge central arch.

The building of the five approach spans on each shore has not presented any great engineering difficulties and this work has been completed to the point of placing in position the steel plates forming the foundation of the footpaths. The spans are each 135 ft. in length and are designed to carry a central roadway of sufficient width to accommodate six lines of traffic, and flanked on each side by two sets of electric rails. In addition, each side will carry a pathway for foot passengers.



Riveters at work on the first panel of the main arch of the Sydney Harbour Bridge

The southern abutment tower has been completed, and extends to a height of 285 ft. above mean sea level. On this side of the harbour the work is most advanced, and the actual building of the south portion of the great arch was commenced recently. Work on this side of the harbour will shortly be retarded, however, until the construction of the northern abutment tower is completed. When operations on both sides of the harbour have reached the same stage the construction of the arch will be proceeded with in earnest, for the contractors' scheme is that the arch shall be built across the harbour at the same rate from each side.

This work will form the most spectacular phase in the construction of the bridge, and it involves placing in position no less than 38,000 tons of steel. The construction of the bridge spans and the other work so far carried out is regarded as child's play in comparison with the task now being entered upon, and the bridge engineers make no secret of the fact that the building of the arch will be the most critical and, therefore, the most anxious period of the whole work.

First of all rams will be constructed on steelwork staging on the abutment towers. The top surfaces of the rams will correspond to the level and plane of the top chord of the arch, and upon these rams "creeper" cranes will be mounted, one at each tower. Each of these cranes is 570 tons in weight and has a lifting capacity of 120 tons. They will be used to carry the steel members of the arch over the water, and as each portion of the arch is secured in position the cranes will move forward on the top of the chords of the arch, and will lower the next portion of the steelwork into its appointed place. In this manner the arch will be built up panel by panel until the centre of the span is reached.

The arch is being fabricated in panels and this work is being carried out in the huge workshops that Dorman Long & Co. Ltd. have established at Milson's Point, and in which the steelwork of the approach spans was assembled. They are the largest and most up-to-date shops ever used in bridge construction, and the building of them alone was a big undertaking, since it involved the levelling of thousands of tons of solid rock. The shops have been erected alongside a deep water frontage that enables vessels from overseas or from other parts of the Australian coast to bring any material for the bridge and discharge it at the bridge itself.

In these workshops a large staff of men, working in two shifts daily, are busy turning out pieces of steel weighing from 70 tons up to 220 tons each—a record in the fabrication of steelwork. The equipment of the workshops include two 120-ton and five 25-ton travelling cranes, more than thirty 8 ft. radial drills, and numerous large hammers and riveting yokes. These yokes are not simply "rattlers," but great hydraulic machines capable of handling the largest pieces of material.

As the arch panels are put together in the workshops they are placed on a punt and towed into the required

position beneath the spot at which they are to be hoisted by means of the powerful creeper cranes.

An enormous cable anchorage will be constructed to hold back the arch during construction, lest unequal strains cause it to fall into the harbour. This anchorage will consist of 128 huge steel cables, each of which will be secured to the top of the end post of the arch; the other end of each cable will be secured in one of a group of tunnels 120 ft. deep in the solid rock. These tunnels are inclined at 45 degrees and meet to form a loop enclosing a mass of solid sandstone, the weight of which is sufficient to resist the upward pull of the cables. According to Dr. Bradfield, the designer of the bridge, these cables will ensure the rigidity and safety of the steelwork in the worst possible conditions of weather, including the severest gales that may visit the locality.



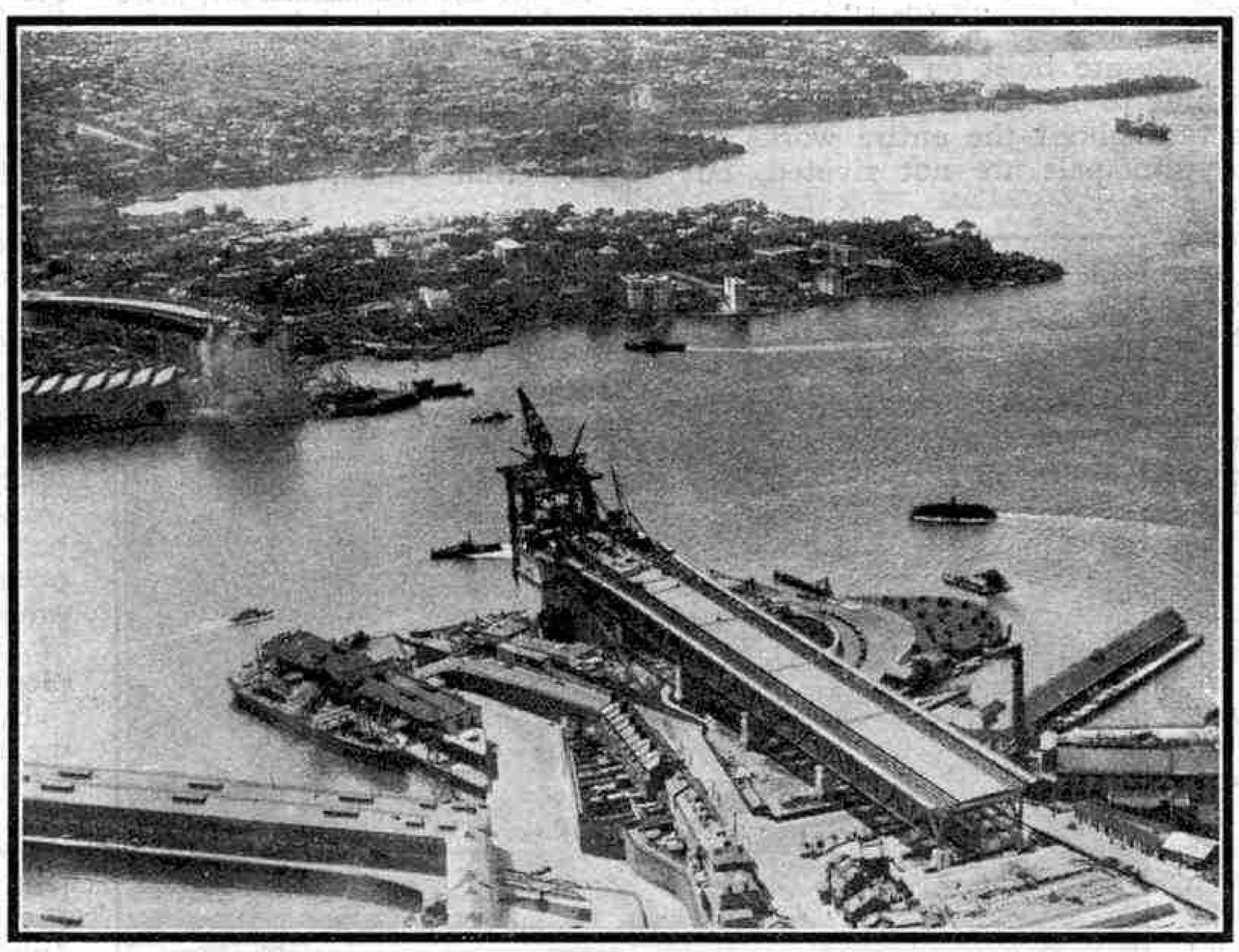
Lowering one of the huge girders into position

When the two half arches are complete there will be a gap at the centre of the span of about 11 ins. Adjustments will then be made by means of jacks that support struts at the back at ground level; the half arches will be lowered and the tension on the cables gently released. The two halves of the arch will come together slowly and a connection will be made in the centre of the lower chord, when the huge arch of over 50,000 tons will become self-supporting in what is known as a three-hinged condition. That is to say, it will have a hinge at the centre of the lower chord, in addition to one at each of the springings. By means of hydraulic jacks the upper chords of the two half arches, which have been constructed likewise with a gap of several inches between their faces, will be forced apart until the direct compression in these members reaches the amount calculated. Wedge-shaped packings will then be inserted, the jacks removed, and the cover plates riveted up. The cover plates at the centre of the lower chord will then be riveted into position and the arch will be in the two-hinged condition. When the completed arch has been locked in this manner the erection cables will be removed.

The work just described will be followed by the erection of the decking of the bridge and the building up of the roadway and footpaths. At the same time the electric track will be laid.

To the layman the engineering precision that has to be maintained in every individual section of work connected with the building of the bridge seems so fine as to be almost impossible of achievement. The engineers in charge of the work, however, point out that it is all based on mathematics. Even so, the slightest discrepancy would be fatal, and astounding precautions and double checkings have to be taken until everyone is satisfied that exactitude has been attained.

As stated in an earlier article on this subject, the bridge will have a maximum capacity of 168 electric trains, 6,000 road vehicles, and 40,000 foot passengers per hour. It is unlikely that the present population of Sydney will ever necessitate such a load being carried, but New South Wales has looked ahead to the time when, instead of her city and country population totalling scarcely more than 2,000,000, it will be twenty times this figure. By then it is probable that there will be other bridges across the harbour, but until that time comes the bridge now under construction will be adequate for all the demands that a rapidly growing city is likely to make upon it.



Aerial view of the bridge site, showing the practically completed approach spans and abutment towers

The contract calls for the work to be completed by 1931. In that year Sydney intends to invite the whole world to a great exhibition to commemorate the opening of the bridge, and to substantiate the claim that Sydney is the second city of the British Empire.

Other photographs of the building of the bridge will be found on pages 612 and 613.

Up to date, something like seventeen thousand tons of steelwork has been erected, of which the largest portion is, of course, in the approach spans. At the present time Dorman Long & Co. Ltd. are employing nearly one thousand men on the bridge work and on its various ramifications, including the Moruya Quarry in New South Wales, from which all the granite used in the construction of the pylons, piers and abutments of the bridge is being obtained.

HOW THINGS ARE MADE

Steam Units for Road and Rail

The "Sentinel" Works at Shrewsbury

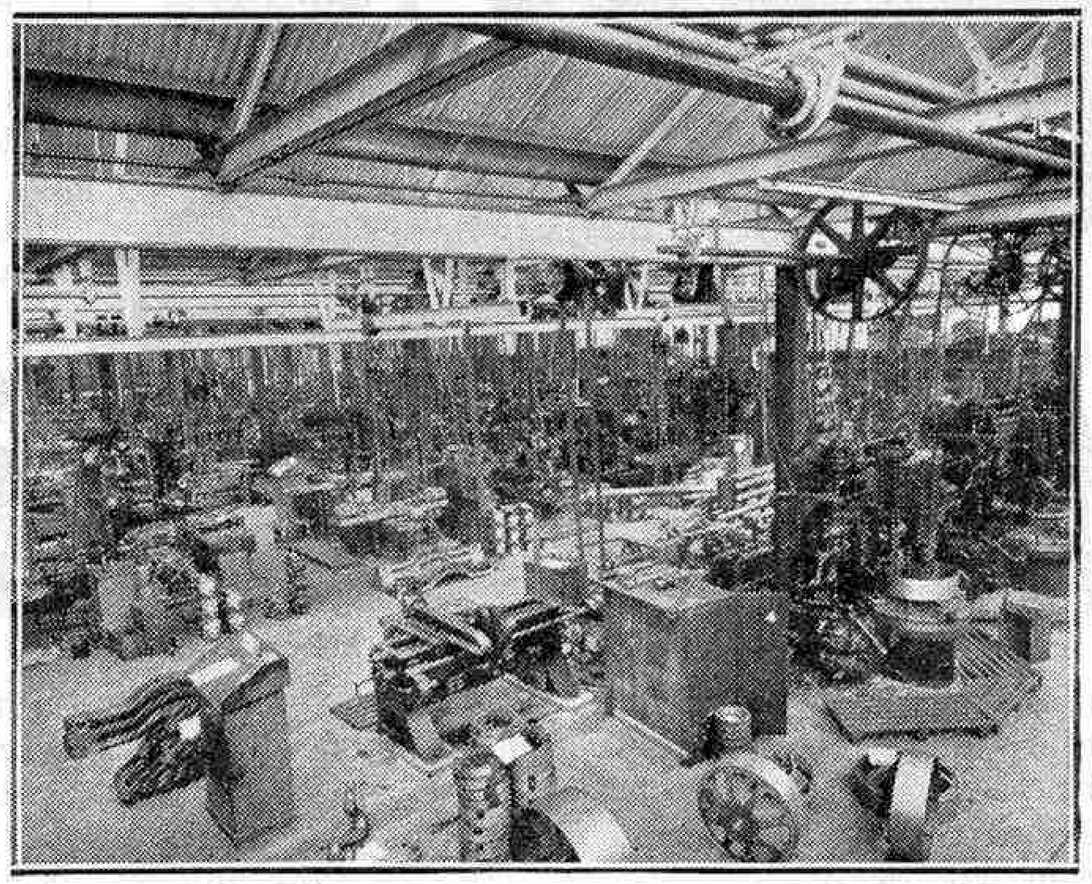
ONE of the most interesting works of its kind in the country is the home of the well-known "Sentinel" steam wagons and locomotives at Shrewsbury. The great factory is situated on a plot of land 65 acres in extent, and occupies a site that flanks the road between Shrewsbury and Whitchurch. The works proper are on the western side of the road, the eastern side being reserved for a garden village, playing fields, and open spaces for recreation of all kinds. There is a canteen that will seat 1,000, where good food may be obtained by the workpeople at practically cost price. Staff dining rooms are attached to the canteen.

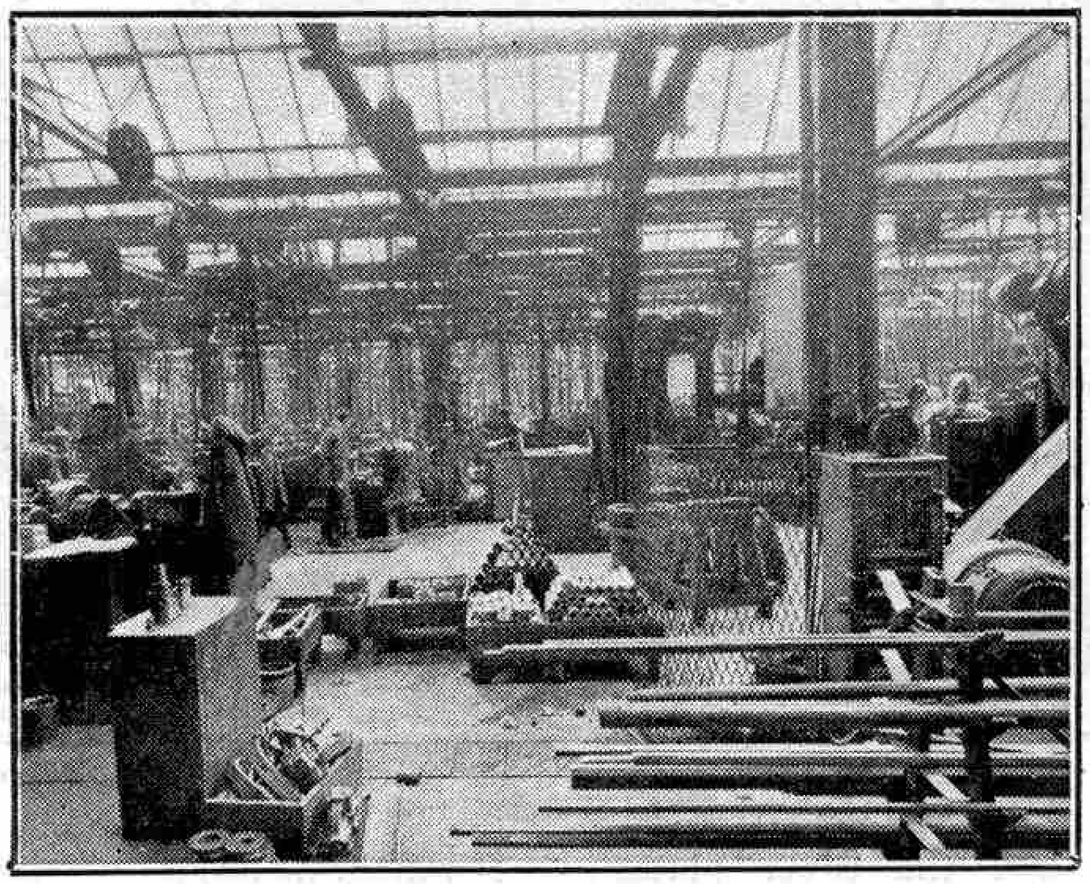
The two-storey ferro-concrete building that is at the entrance to the works, and which abuts immediately upon the road, is used for the offices. The ground floor of this building is devoted to an extensive drawing office with some 50 draughtsmen and tracers, and to the administrative offices under the supervision of the works manager. The floor above is divided equally between the accounting department and the sales department. Owing to the nature of the products made by the company, it has been found that single-storey saw-tooth buildings suit their purpose best, and accordingly all the shops are built on this plan. In order to simplify construction and to facilitate alterations and extensions all the roof trusses throughout the entire works are standardised. Further, all the principals are not riveted, but bolted together, so that it is a simple matter to erect them or move them according to requirements. Whenever a new bay or a new building is erected, provision is made at all the columns for the connection of further bays or buildings. Throughout the whole works the spacing and layout of all buildings is a multiple of the bays; thus when extensions become necessary there is no difficulty in fitting buildings in between those already in existence.

The works are laid out upon what is known as the "constant flow" principle. In other words, as far as is possible all materials for manufacture travel in one direction from the spot at which they enter the works to the place where the finished product is delivered. This principle has a very important bearing upon the economics of manufacturing, and it is largely responsible for the successful development of mass production.

In the "Sentinel" works the flow is from a siding at the western side of the works to a road at the eastern side, the works being laid out between the L.M.S. main line from Shrewsbury to Crewe and the road already mentioned. Most of the raw material required in manufacture comes in by rail, and in order to maintain the direction of flow without interruption all material that comes in by road is sent to the railway siding to be put into circulation from that point.

Immediately flanking the large concrete off-loading platform, which abuts on to the siding, is a large rough-part store. Into this are received all materials that require no preliminary treatment. Certain castings after being received must be "aged," and these are stacked in a special space adjoining the siding. Others must be "pickled" before they are fit to be machined, and therefore a pickling tank and gear are situated at one end of the off-loading platform.





The photographs on this page show views of the extensive main machine shop in the "Sentinel" Steam Wagon Works at Shrewsbury (see below)

The main rough-part stores runs completely along the end of all the bays that constitute the main machine shop. This shop has an area of over 45,000 sq. ft. and, in addition to being fitted with all the most modern machine tools, it also houses a large number of special machines expressly evolved for carrying out work on "Sentinel" engines and other units. Among these special machine tools may be mentioned the inserted tooth straddle milling machine for facing the ends of the crank cases and for facing cylinder castings to length; and the compound lathes that carry out the boring of the crank case end covers, while at the same time they form the spherical bearings by which the engine is hung in the chassis. There is also a special drilling machine which, at one operation, drills all the chain wheel bolt holes in the spokes of the road wheels, and at another operation reamers the holes already drilled.

A feature of this and all the other shops is that they are driven electrically by means of individual motors installed in each bay, and that every yard of shafting throughout the entire works is carried on anti-friction ball bearings. The saving in power thus effected amounts probably to some 25 per cent. of the useful power that is employed throughout the works.

In prolongation of the main machine shop and separated from it by one of the works streets are the spare parts machine shop and the erecting and the paint shops. The second of these covers 16,200 sq. ft. and is divided into two portions that constitute the wagon and the locomotive erecting departments respectively. The former is a plain shop practically devoid of machinery. Into it are brought frames from the frame shop, engines complete from the engine erecting bed, and the axle assemblies from the sub-assembly erecting shop in the machine shop. The frames are laid upon trestles of such a height that the axle assemblies can be slipped under them readily. The engine is dropped into place by means of an overhead crane, and

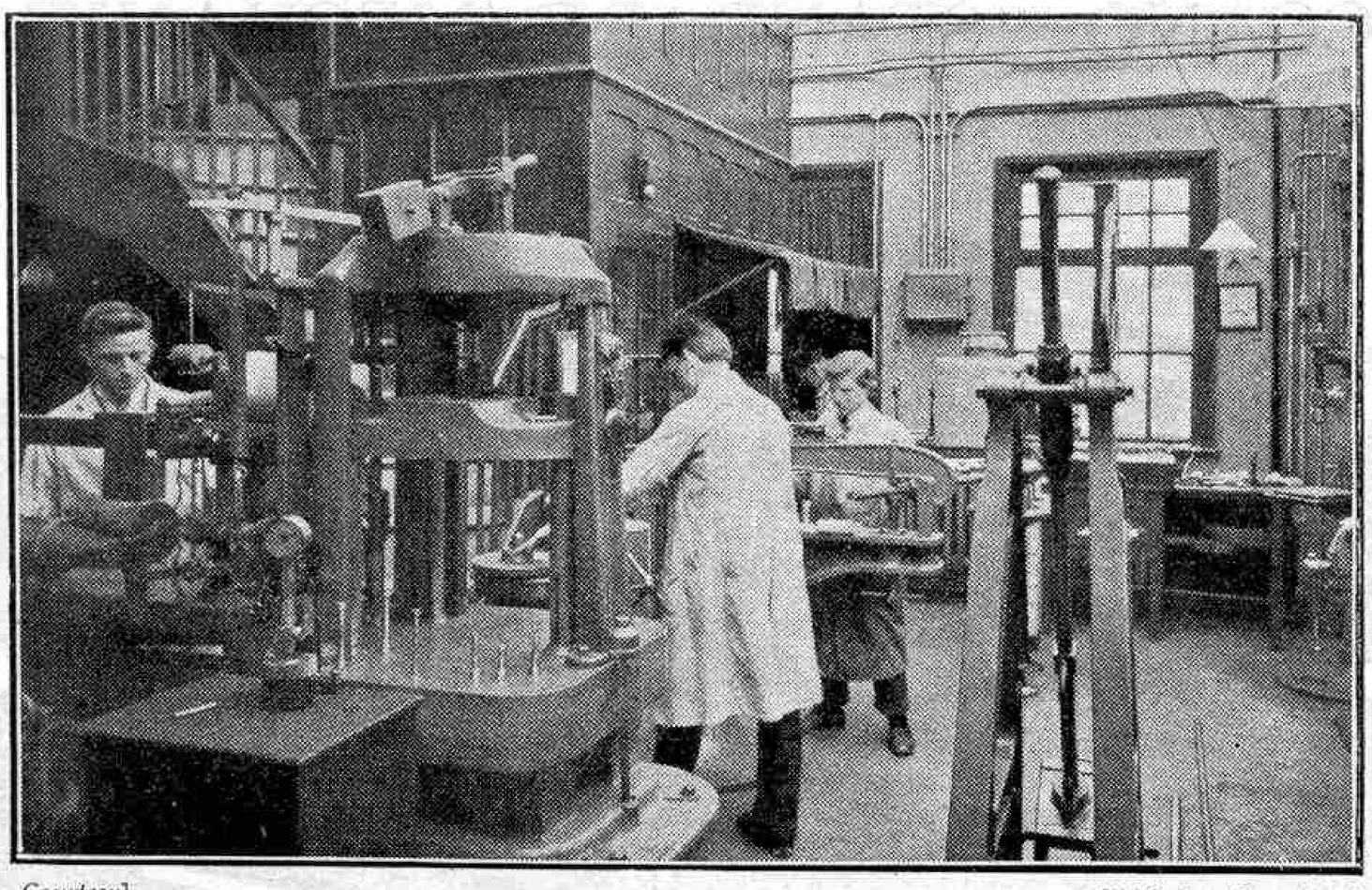
The machine shop, which has a floor space of more than 25,000 sq. ft. For the above illustrations we are indebted to "Modern Transport"

at the same time the cab, boiler and other fittings reach the erecting shops by roads specially laid for each purpose.

Adjacent to the wagon erecting shop is the pipe-bending department where all piping is made for both wagons and locomotives. Before any "Sentinel" engine leaves the engine erecting bed it is tested by compressed air and the valve clearances and settings are checked. When completed, the wagons are passed out at the farther end of the assembly shop and sent for test.

The other half of the erecting shop is devoted to the erection and testing of "Sentinel" locomotives and power-units for the well known "Sentinel-Cammell" rail-car.

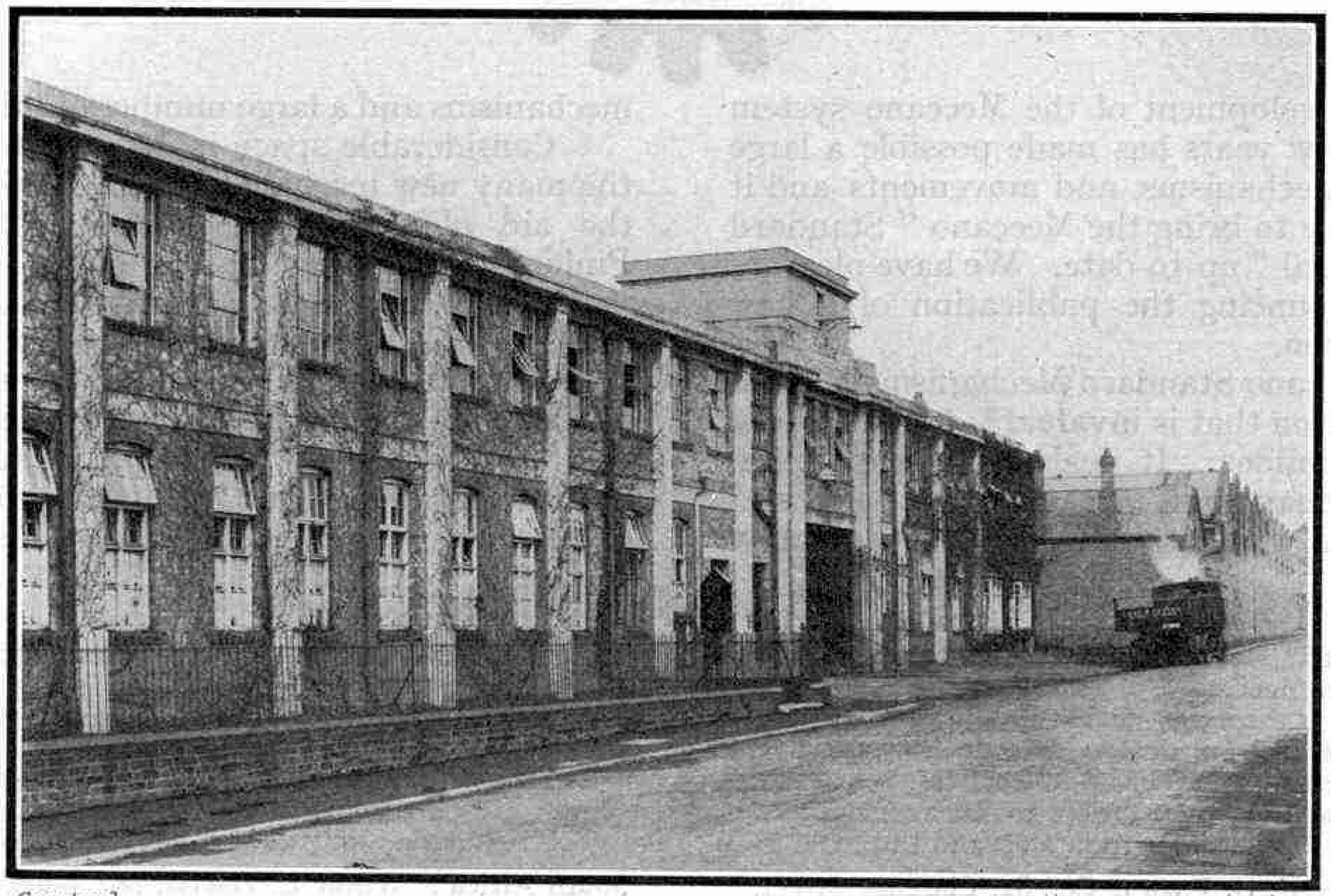
In this shop there is a bed for testing the pulling powers and general running of the locomotives placed half-way down the shop. This testing bed, which was developed specially for testing "Sentinel" locomotives, consists essentially of three sets of rollers, grooved in such a manner as to accommodate any gauge from 75 mm. up to 5 ft. 6 in. The rollers are carried in substantial plummer blocks sliding upon machined beds, the latter being sunk in a pit under the floor of the erecting shop. By means of suitable screw gear, the distance from roller to roller can be varied so as to accommodate locomotives of different wheelbases, as well as of different gauges. Through suitable gearing the rollers drive two generators, the output of which is absorbed in resistances of the liquid type placed alongside the test bed. The whole outfit is provided with speed indicator, dynamometer, voltmeter and ammeter, so that the performance of any locomotive under test can be readily determined. Every "Sentinel" locomotive passes over this test bed before it is allowed to leave the works.



Courtesy ["*Modern Transport*"

The laboratory in which physical and chemical tests of raw materials are carried out

Wagons are tested upon a similar machine, placed in what is known as the running shop, or garage. The differences arising from the use of rubber tyres and a fixed gauge call for the use of wood-faced drums on the wagon testing machine instead of rollers as used for locomotives. It is possible on the wagon testing machine to alter the pitch of the drums in order to accommodate wagons of different wheelbases. The load imposed by the wagon testing machine when in operation is equivalent to running a wagon up a 1 in 10 hill for four hours, a test far more severe than any that could be met with on the road.



Courtesy ["*Sentinel*" *Wagon Works Ltd.*

The office and main entrance gates of the "Sentinel" Works. **A six-wheeled "Sentinel" is seen leaving for road test**

Since these testing machines were installed it has been found easier to turn out a standardised product than was the case when testing on the road alone was relied upon. It might seem quite a simple matter to devise a standardised road test, but this is not the case. The atmospheric conditions are never exactly alike on two successive days, and the state of the roads, visibility, and the traffic also vary from day to day. By eliminating these variable features, as is done on the testing machines, standardising has been developed to such an extent that every wagon that leaves the "Sentinel" shops is exactly the same as regards fuel consumption and every other detail of its performance. Naturally, all wagons go through a final test on the road, after coming off the test bed, to ensure that the steering and brake gears are functioning perfectly.

The paint shop, which lies adjacent to the wagon side of the erecting shop, is 9,000 sq. ft. in extent. For work in the winter and at night, a system of lighting has been devised that gives an effect almost equivalent to daylight. The painting of wagons might be thought a very simple affair, but as a matter of fact the process is both long and difficult, occupying from 12 to 15 days, during which period every wagon receives 12 coats of paint. Locomotives receive similar treatment, but as there is usually a smaller amount of lettering required, the work can be done in less time.

The running shed, in which is situated the wagon testing machine already referred to, measures 20,800 sq. ft. It is fitted with a special smoke exhausting system consisting of a sheet iron flue running the whole length of one side of the building. This flue has opening out of it a number of downtakes arranged so that they come immediately over the chimneys of each wagon as it is garaged. In this manner the fumes from the wagon are made to pass straight into the flue, from where they are exhausted rapidly by means of an electrically driven fan.

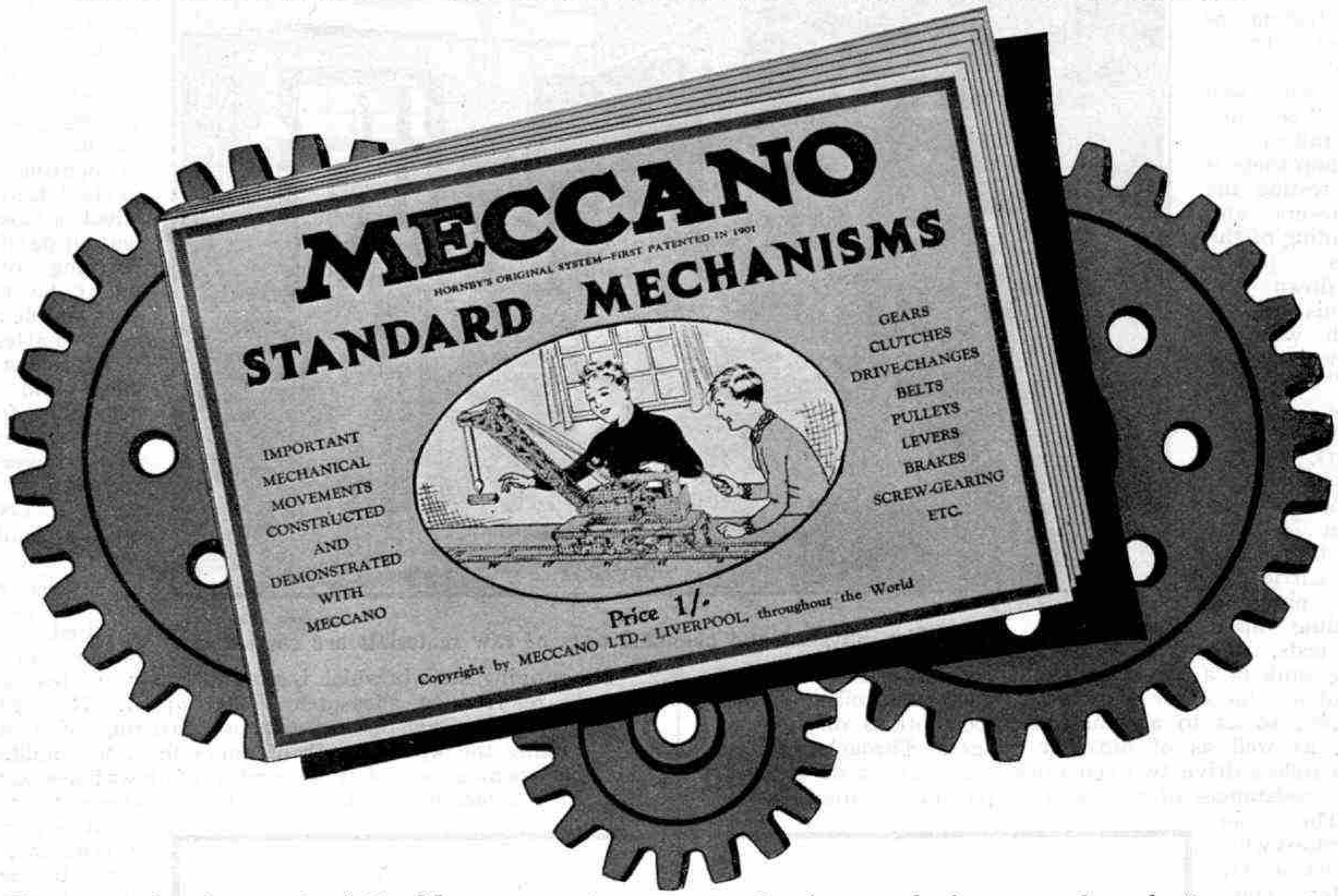
The woodworking and body-building shops are situated by themselves on the north side of the works. They are laid out upon the same principle of uni-flow of material that is adopted in all the other parts of the works. A great deal of special machinery has been designed for use in the woodwork shop, including a machine that not only deals with the ends of cross members by reducing them so that they fit the standardised ironwork of the body, but also at the same time drills the necessary bolt holes. Each body is built upon trestles, and is moved down toward the end of the shop as one operation after another takes place.

The works laboratory is exceedingly interesting. It is divided into two parts, physical and chemical, and the work is carried out by a thoroughly competent staff under the control of a works metallurgist. In this laboratory tests are made of two per cent. of all the materials delivered, so that there may be absolute assurance that these comply with the rigid specifications laid down.

To supply power and light to the works there is an efficient

YOU *must have this new Manual*

MECCANO "STANDARD MECHANISMS"



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Considerable space is devoted to particulars of the many new mechanisms that can be devised with the aid of the new Socket Coupling, elongated Pinions, and Bevel Wheels, etc. The uses of the new Roller and Ball Bearings are also dealt with fully. In addition, electric braking and governing devices have been included, and these form valuable additions to the range of existing mechanisms. The book contains over a hundred beautiful half-tone illustrations, which greatly simplify the construction of the more complicated movements.

HOW TO OBTAIN THE MANUAL

The 1929 Meccano Standard Mechanisms Manual may be obtained from any Meccano dealer, price 1/–, or direct from Meccano Ltd., Old Swan, Liverpool, price 1/1½ post free.

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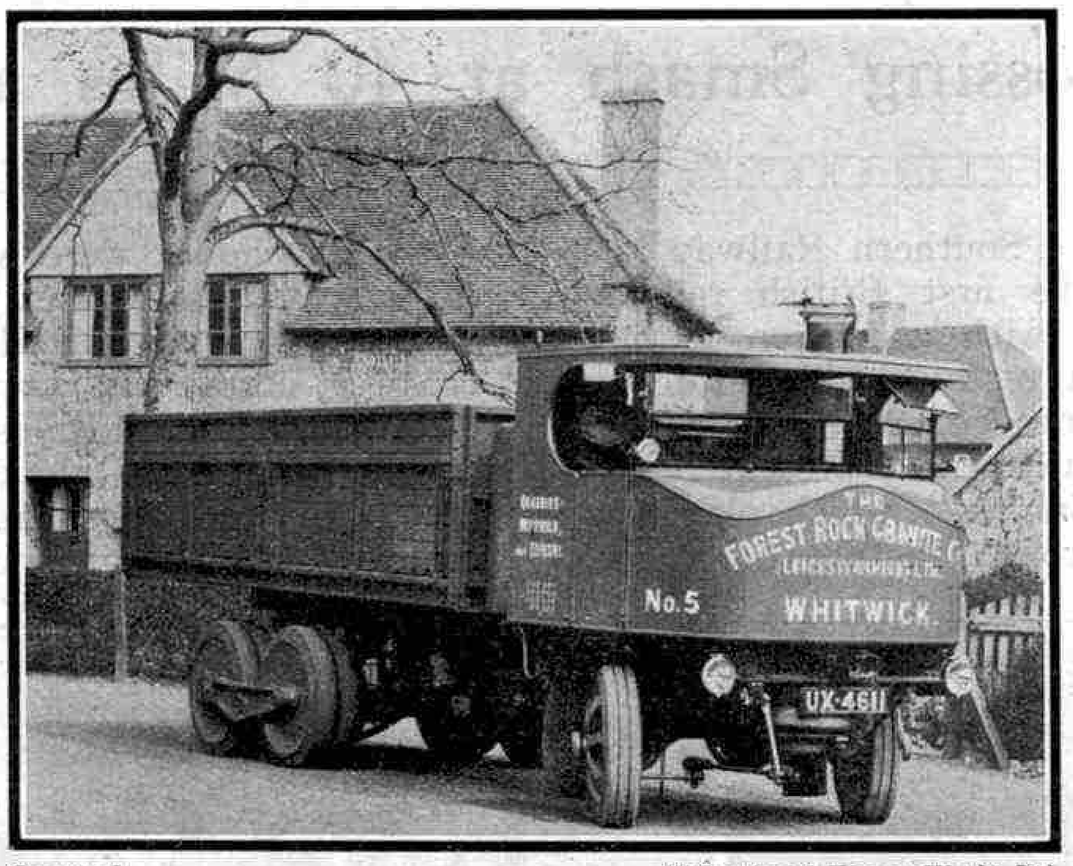
Canada : Meccano Ltd., 45, Colborne Street, Toronto.

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and up-to-date power house. This is situated in the extreme corner of the works. The equipment consists of two Bellis and Morcom compound high-speed engines driving two tandem generators of 200 kw. each. For the supply of compressed air in the works, where it is extensively used for driving hand drills, riveters, chisels, etc., there are four Alley and McLellan compressors driven by standard "Sentinel" wagon engines. In addition to supplying power and light to the works, the power house also supplies light and hot water to the garden suburb on the other side of the road. This suburb was brought into being by the shortage of houses experienced immediately after the war. It consists at present of 100 houses of the village type, but eventually the scheme visualises 400 houses.

For over 25 years the "Sentinel," and subsequently the "Super-Sentinel," steam wagons have been familiar on every road in the country. More recently a new model has made its appearance. This wagon is a six-wheeler with a load capacity of from 12 to 15 tons, and has been introduced with the special object of dealing with the heavier loads that have become customary since the War. It has many novel and interesting features, prominent among which is the oscillating rear bogie that carries the four driving wheels. This bogie consists essentially of a fixed axle of great strength, on each end of which is pivoted a pair of cast steel arms. At each end of these pairs of arms are short fixed axles on which the rear wheels run.



Courtesy] ["*Sentinel*" *Wagon Works Ltd.*

A "Sentinel" six-wheeler standing outside the Garden Suburb in which many of the men employed in the "Sentinel" Works reside

The result of this arrangement is that, no matter what irregularities may be met with on the surface of the road, the arms will swing automatically and allow the weight of the wagon and its load to be distributed evenly between both wheels on each side of the vehicle. This, of course, reduces the amount of power required to propel the "Sentinel" D.G.6, as this model is called, for instead of the power of the engine being absorbed in lifting the weight of the wagon and load over irregularities, it is expended usefully in driving it forward. The result is that less steam is required for the engine, and consequently less coal needs to be burnt in the boiler.

To-day the steam wagon is being used more and more for the transport of heavy loads, and from a national point of view this is all to the good, as every one put into service on our roads adds its quota of employment for the miners and keeps money in the country that otherwise would go abroad to pay for imported liquid fuel.

How to Use Meccano Parts—

(*Continued from page 638*)

employing the special units. Such a built-up Roller Bearing, employing guide races formed from Channel Segments, is described under Standard Mechanism No. 131.

The standard Meccano Ball Bearing (part No. 168) is illustrated in Fig. 14, and as will be seen it consists of three sections, namely, one Flanged Ball Race, one Geared Ball Race, and one Ball Casing complete with Balls. With its aid a structure may be turned about a central pivot freely and in a steadier manner than is possible with ordinary bearings. It is intended for use, of course, where the Roller Bearing would prove unnecessarily cumbersome.

Fig. 13 shows the application of the Ball Bearing to a small crane. The Flanged Ball Race 1 is secured by bolts to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate 2, and the Geared Ball Race 8 is fastened to the swivelling structure. The Ball Casing is placed between these two parts so that the Flanged Ball Race rests upon the Balls. Hence the weight of the structure rests entirely upon rolling surfaces, with the result that friction is reduced to a minimum. A short Rod passed through the centre of the Ball Races 1 and 8 and maintained in its position by Collars, holds the unit together. The superstructure is rotated by means of a Sprocket Chain passing round the teeth of the Geared Ball Race 8 and engaging a 1" Sprocket Wheel 3 which is secured to a driven Rod 4.

Another example of the use of the Ball Bearing unit is illustrated in Fig. 12. Here it is shown applied to a model mechanical digger and in this case the Flanged Ball Race 1 rests upon the Balls, although in the illustration it is seen lifted clear. Also, spur gearing is employed to rotate the superstructure instead of Sprocket Chain mechanism as in Fig. 13. The $3\frac{1}{2}''$ Gear Wheel 2, which replaces the Geared Ball Race, is secured to Girders in the travelling base of the model by four $\frac{1}{2}''$ Reversed Angle Brackets 4. The $\frac{1}{2}''$ Pinion 5, which is secured to a Rod that is driven by any suitable means from the motive power carried on the superstructure, engages with the Gear Wheel 2 and thus effects the swivelling movement.

New Meccano Models—

(*Continued from page 635*)

consists of two triangular frames formed from $5\frac{1}{2}''$ Strips, and connected together by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. Two Flat Trunnions form bearings for a Crank Handle upon which the lower ends of the bascules are pivoted. The latter each consist of two $12\frac{1}{2}''$ Strips spaced apart by means of Double Angle Strips. If necessary cardboard may be added to form a roadway.

Two separate lengths of cord are wound round the shaft of the Crank Handle, each length being passed over a 1" Pulley Wheel journalled on a $3\frac{1}{2}''$ Rod passed through the $5\frac{1}{2}''$ Strips and secured to the top of its respective bascule.

The parts required to build this model are as follows:—4 of No. 1; 6 of No. 2; 1 of No. 16; 1 of No. 19s; 2 of No. 22; 8 of No. 35; 16 of No. 37; 2 of No. 38; 6 of No. 48a; 2 of No. 126a.

Foot Treadle Hammer

The prototype of the model shown in Fig. 7 may often be found in a small forge or village smithy, the owner of which has not yet called in the aid of steam or electricity to assist him at his task!

To build the model hammer, four $5\frac{1}{2}''$ Strips should be bolted to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and connected together at their upper ends by two $2\frac{1}{2}''$ Strips and two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.

The "hammer" consists of a $5\frac{1}{2}''$ Strip bolted to a Bush Wheel that is mounted on a $3\frac{1}{2}''$ Rod journalled in one of the pairs of $5\frac{1}{2}''$ Strips. The Rod also carries two 1" Pulleys butted against a $2\frac{1}{2}''$ Strip. A weight consisting of a number of short Strips is secured to the end of this $2\frac{1}{2}''$ Strip, so that the hammer is raised automatically after each stroke.

Parts required to build the Treadle Hammer are:—6 of No. 2; 1 of No. 3; 9 of No. 5; 1 of No. 12; 2 of No. 16; 4 of No. 22; 1 of No. 24; 2 of No. 35; 15 of No. 37; 4 of No. 37a; 2 of No. 38; 2 of No. 48a; 1 of No. 52; 4 of No. 90a; 2 of No. 111c.

Models in the £100 Contest—

(*Continued from page 653*)

and a $1\frac{1}{2}''$ Angle Girder secured to the end of the exhaust pipe to form the "baffle chambers," while a Corner Piece represents a "fish tail" of extra large size!

In addition to the solo machines, model cycle and sidecar combinations were to be found in great profusion, constructors here again showing preference for the racing types of machines. Many interesting types of sidecars were to be found amongst these models, the examples ranging from flat "stream-line" patterns composed of Sector Plates and Flat Girders, to graceful boat-shaped bodies built up from various sizes of Curved Strips.

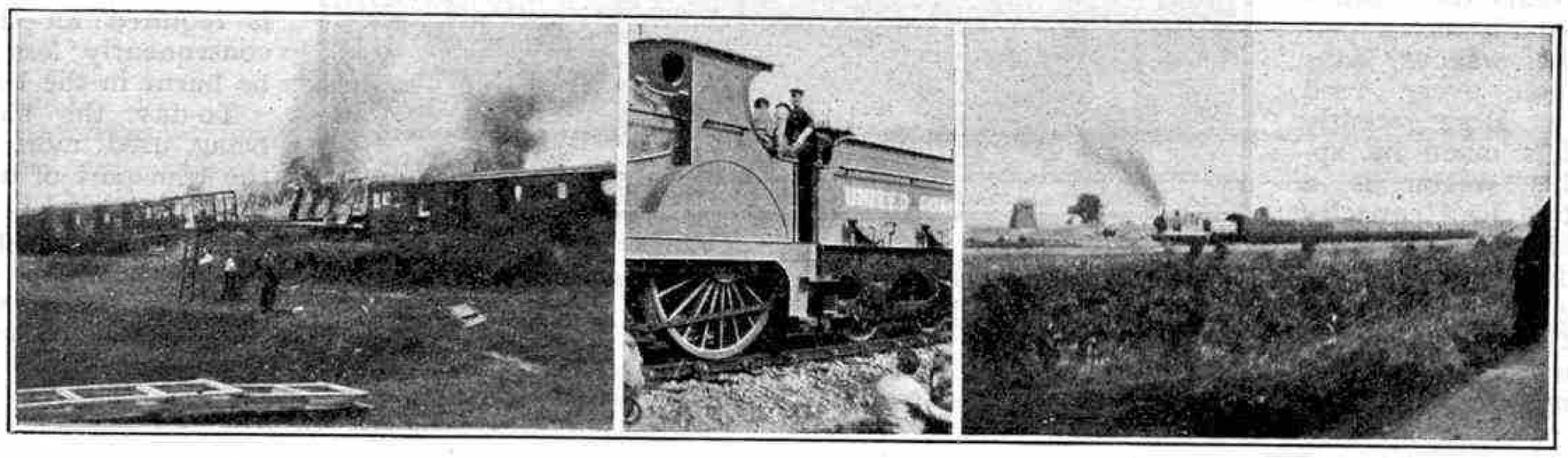
An original feature of C. R. Weller's model cycle and sidecar is the inclusion of a two-speed gear box. The engine in this machine has been represented by an Electric Motor, and the gears comprising the speed change mechanism are mounted in the perforated side plates of the Motor. In this instance, the additional speed ratio will be found useful, as a rather massive sidecar is attached to the cycle.

By employing a Meccano Clockwork or Electric Motor, the attraction of a model motor cycle is enhanced considerably, but unless special care is taken in fitting, the appearance of the complete machine is likely to suffer.

A Railway Accident To Order

Level-Crossing Smash at 40 Miles an Hour

TO its many distinctions the Southern Railway has added that of being the first British railway company to collaborate with a motion picture company in order to stage a really thrilling railway smash. The object of this arrangement was to enable cinematograph pictures to be taken to represent realistically a scene from "*The Wrecker*," which play was being filmed by the Gainsborough Picture Company. For this purpose a Southern Railway train consisting of an engine and six bogie coaches was purposely set travelling at express speed down a steep incline, to crash into a steam wagon at a level crossing.



(Centre) Dummy driver and fireman being placed in position. (Right) The train rushes to destruction. (Left) Filming the burning carriages after the "accident." For the illustrations and information contained in this article we are indebted to the Southern Railway

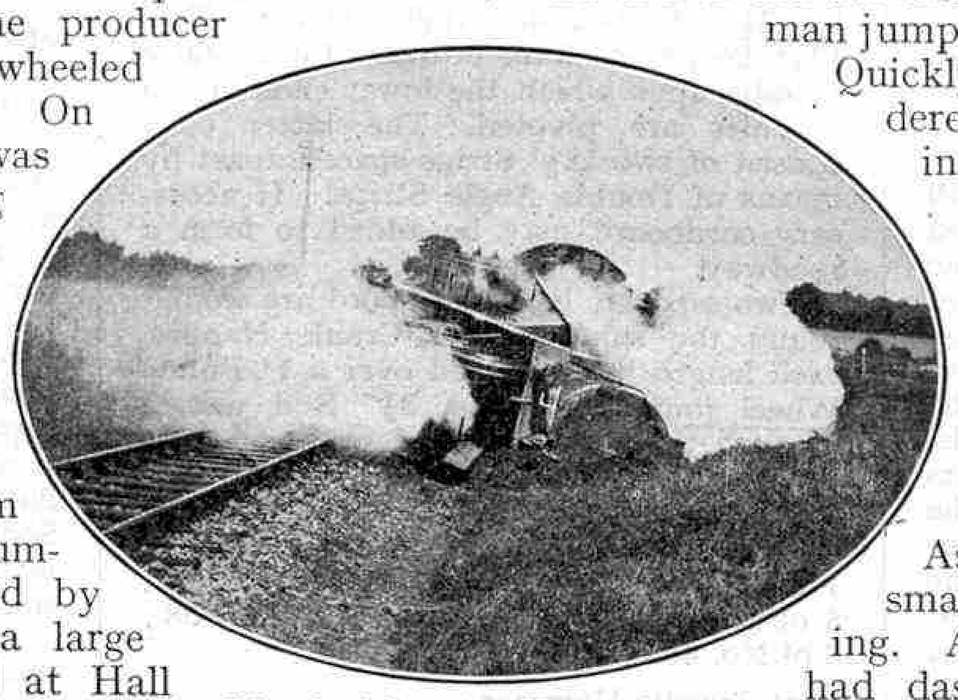
The place chosen for the "accident" was Salter's Ash Crossing on the Basingstoke and Alton branch, and the preliminary operations were very extensive. For several weeks a large number of men had been engaged in digging trenches, carting hundreds of sandbags to the scene, and erecting dummy haystacks to ensure the safety of the 21 camera operators. The Southern Railway had sold the producer a six-bogie set train and a four-wheeled coupled express engine, No. A148. On the tender of the engine, which was painted grey, was the lettering "*United Coast Line.*"

On the appointed day a special corridor dining train arrived at Herriard Common from Waterloo at 6.30 in the morning, bringing the chief officials to make the final preparations. The film operators, actors and friends, numbering in all about 200, arrived by motor cars and proceeded to a large marquee that had been erected at Hall Farm, Lasham, which overlooks the railway and cornfields in the vicinity of Salter's Ash Crossing.

Elaborate precautions were taken in order to ensure that the sham accident should not give rise to any real ones. All the roads in the neighbourhood were blocked, except for those with permits or passes. A large force of Hampshire Police and St. John's Ambulance men were present to keep the public out of danger and also to ensure the safety of all those taking part in the various operations.

Several hours were spent in rehearsing, the train being sent up and down the track, while a steam wagon loaded with sand travelled to and fro over the private crossing across the cornfield. In the meantime the electric communications between the crossing and the starting point about half-a-mile away were completed by the linesmen. Two 30 ft. rails were then removed, the wagon was run into position across the track, and two dummies were placed on the locomotive to represent the driver and the fireman. On the engine also were a real driver and fireman, the former with regulator in hand waiting for the signal to set the train in motion. On the front of the engine was fixed an electric camera.

At 1.10 p.m. the signal "Right Away" was given by the chief film producer at the bottom of the incline —1 in 50—to the operator by the line, who then gave the "Full Steam Ahead" to the driver. Swiftly the driver set the train in motion, and he and his fireman jumped to safety.



Wrecked for the films—the end of engine A.148

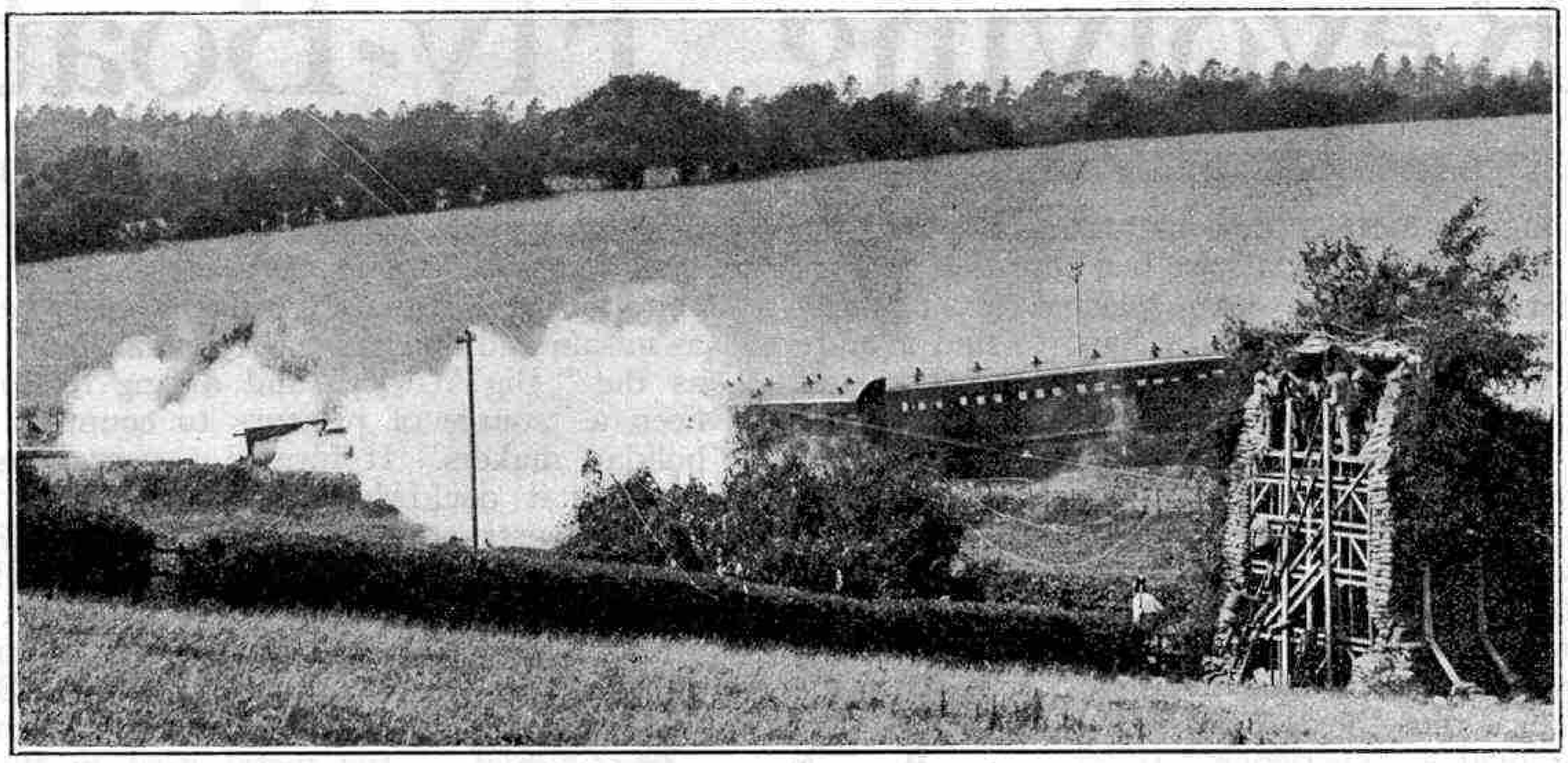
Quickly gathering speed the train thundered down the slope. All was over in 71 seconds—the crash occurred at 40 miles an hour!

"Very nice and beautiful," was the cold-blooded comment of one of the operators! The engine was an absolute wreck, and the whole of the train was off the track with the exception of the last pair of wheels. As for the wagon, this was literally smashed to smithereens on the crossing. After hitting the wagon the train had dashed on for a further 100 yds. before toppling over on its side. A 30 ft. rail had pierced the tender and the guard's van.

One might have thought that this harrowing scene was enough for the producer, but he was really only just getting into his stride, and by 3 p.m. the camera men were again at work. The wrecked coaches had been filled with passengers, and when the chief producer gave the signal the doors were opened and the "dying" and "injured" were carried out and laid on the grass in a thoroughly realistic manner!

Even yet the producer was not content. The proceedings must wind up with a fire, and so at 4.15 a lorry load of petrol arrived and the whole lot was poured over the wreckage and set alight. There was no doubt about the realism of the fire, and very soon only the steel framework and wheels were left, with the exception of the last vehicle adjoining the cornfield. More photographs were taken, and then came a welcome interval for refreshments for all concerned.

A special train for Waterloo left at 6.55 p.m., and only the breakdown gang and permanent way men remained behind to clear up the wreckage. This was completed by 10 a.m. on the following day, and normal working was resumed over the branch less than six hours later, which must be regarded as very quick and efficient work.



The smash. Note the camouflaged stand for camera operators on right

Specially staged episodes of this character are new to this country, but are likely to become more common as the British film industry develops.

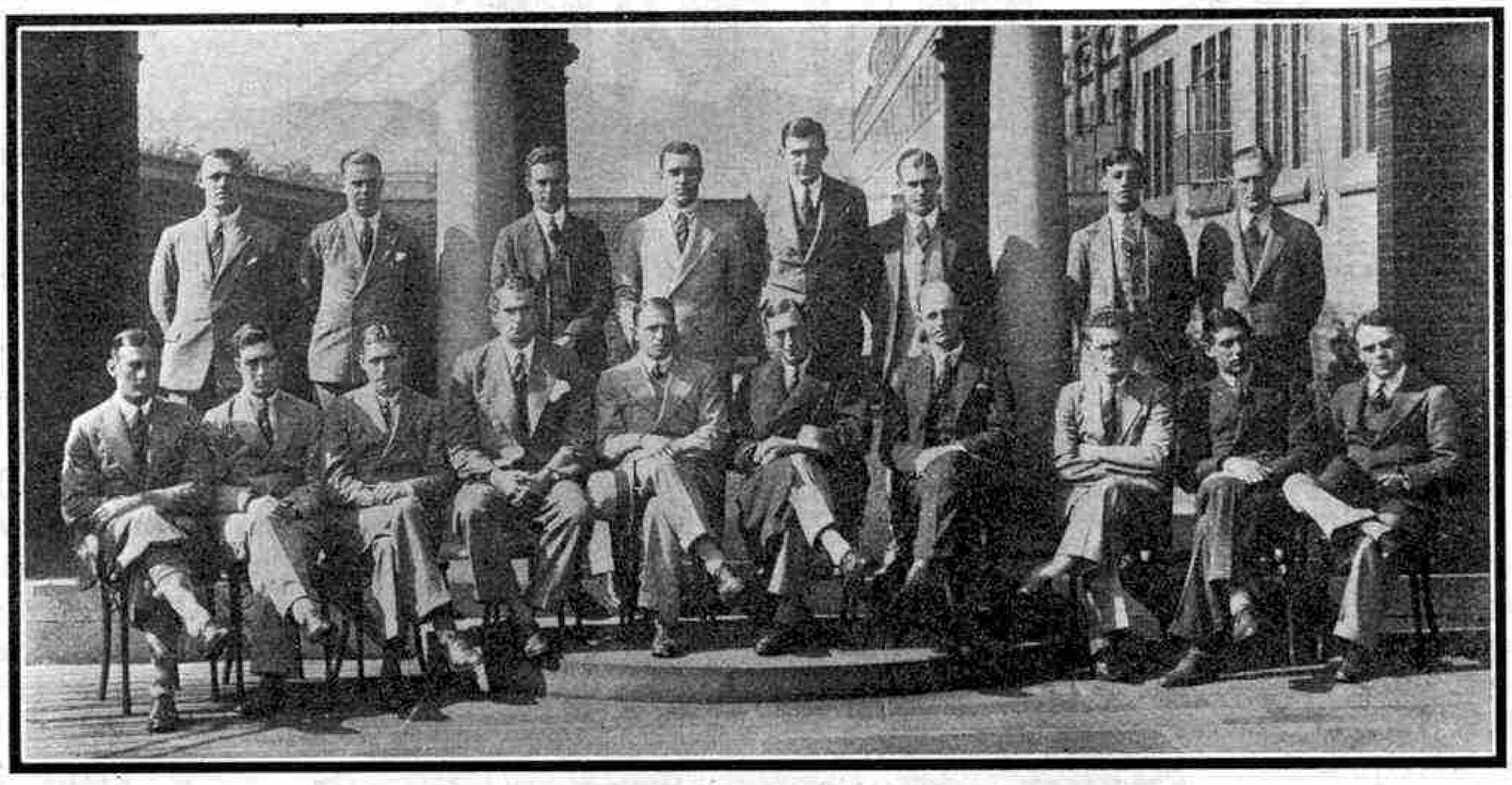
How Mountain Ranges are Built—*(Continued from page 596)*

The layers of sediment thus folded will eventually form mountains. If this explanation is correct, mountain ranges should be on the shores of the ocean. This is the case. The Rockies and the Andes are parallel to the western shores of North and South America ; the mountain ranges of Australia run along the eastern coast of the continent ; and the snow-clad heights of Scandinavia front the North Atlantic Ocean.

The Himalayas and the Alps seem to be exceptions to this rule, but when they were formed the Mediterranean Sea extended thousands of miles to the east. The present sea is only a tiny remnant of an ocean, called the Tethys, that once covered the Sahara Desert and even extended to the Pacific Ocean ; and it was on the northern shores of this great sea that the sedimentary rocks of these two mountain ranges were formed.

It still remains to see how the bent and crumpled layers of sediment have been pushed up. How this comes about will readily be understood if we remember that when a boat passes from fresh river water into the salt water of the sea, it always rises and floats higher.

This is exactly what will happen as the earth continues to cool. The liquid basalt will become denser as its temperature falls, and the continents floating on it will then rise higher, and form new ranges of mountains, continuing to do so until cooling has gone so far that the whole mass becomes solid, when the process will recommence. The newly - made mountains will start on their journey back to the sea ; the layer of basalt below the continents will again begin to get hotter ; and eventually there will be more outpourings of lava, and upheavals will cause new mountains to form. There probably is an interval of nearly 40 million years between such outbreaks and it is scarcely likely that we shall be involved in such a world-shattering period.



Our photograph, which is reproduced by the courtesy of Rolls Royce Ltd., shows the South African Cricket Team at the entrance to the Rolls Royce works in Derby. The members of the team, who are combining educational tours of various modern factories with their cricket itinerary, were particularly interested in the secrets of manufacture of Rolls Royce cars.

Reading from left to right the names are as follows :—

(Back Row) A. L. Ochse, E. L. Dalton, Bruce Mitchell, I. J. Siedle, A. J. Bell, Quintin McMillan, H. G. Owen Smith, A. A. Frew.

(Front Row) D. P. B. Morkel, H. B. Cameron, C. L. Vincent, J. A. Christy, H. W. Taylor, H. G. Deane (Capt.), A. S. Frames (Manager), R. H. Catterall, N. A. Quinn, E. A. Van der Merwe.

New Meccano Model

Revolving Fly-Boats

IN publishing the details for constructing the Meccano model Revolving Flyboats we feel sure that readers will agree that we have selected a singularly appropriate subject. It would be hard to find a more fitting example of the holiday spirit that overtakes all of us at this season of the year, than this splendid model of a large pleasure wheel that may be seen towering above the booths and sideshows of most "amusement parks" or fairs adjoining popular seaside resorts.

No doubt many of our readers will be able to number amongst their holiday recollections a ride in one of these machines and the thrills occasioned by this enjoyable experience. It is indeed exhilarating to step into one of the little cars, and to be carried high into the air and then, as the car descends to the ground, to see the earth apparently rushing up to meet it.

Although often disguised in a cloak of gaudily-painted wood and canvas, the machines to be found in pleasure parks form in many cases unique examples of engineering construction. The design of the many varied and distinctive movements incorporated in the various types of oscillating swings, big wheels and roundabouts has occupied the attention of the most capable engineers and the mechanical features of many of these devices are of a highly ingenious nature.

When the construction of a massive structure such as a revolving wheel is undertaken the utmost care is required in calculating the stresses and strains that will be created when the wheel is in motion, and the strength of the materials employed must always exceed the maximum required. In the correct estimation of these factors lies, of course, the safety of those seeking amusement by riding in the cars of the machine.

A remarkable example of the engineer's work in this direction stood for many years at Blackpool, in Lancashire, but unfortunately it has recently been condemned as unsafe and has had to be dismantled. It was known as the "Big Wheel" and during its long life it has been a source of pleasure to countless thousands of holiday makers. It formed a very conspicuous landmark that could be seen from many miles around.

The construction of the Blackpool Big Wheel was commenced in February, 1896, and the following August saw the giant structure thrown open to the public. The erection was carried out by Lieutenant W. B. Bassett, R.N., and a staff of 250 men. Most of the metal used in the various ties and struts was Scotch Steel, while the spokes and driving cables were manufactured from Lancashire steel cable. From the ground to the topmost girder the height of the structure was 220 feet—the tip of the wheel being 260 feet above sea level! The total weight of the wheel with its 30 cars attached was 1,000 tons, while its superficial area for painting purposes was estimated at 2,000 square yards!

The vast size of this great wheel may perhaps be better realised when it is learned that 2½ tons of paint were necessary in order to apply two coatings to the steelwork! Each of the carriages weighed 3 tons 3 cwt., and was capable of carrying 30 passengers—giving a grand total of 900 passengers that could be carried at one time on the wheel.

The rim of the wheel itself was built of steel girders bolted together and was suspended from the axle by 120 wind ties and spokes of steel cable. For rotating the wheel giant steel cables were used, the total length of which was 3,132 feet, or ¾ of a mile! The splicings on these two cables were recognised as the longest spliced joints in the world. The huge wheel was mounted on a massive steel axle, the circum-

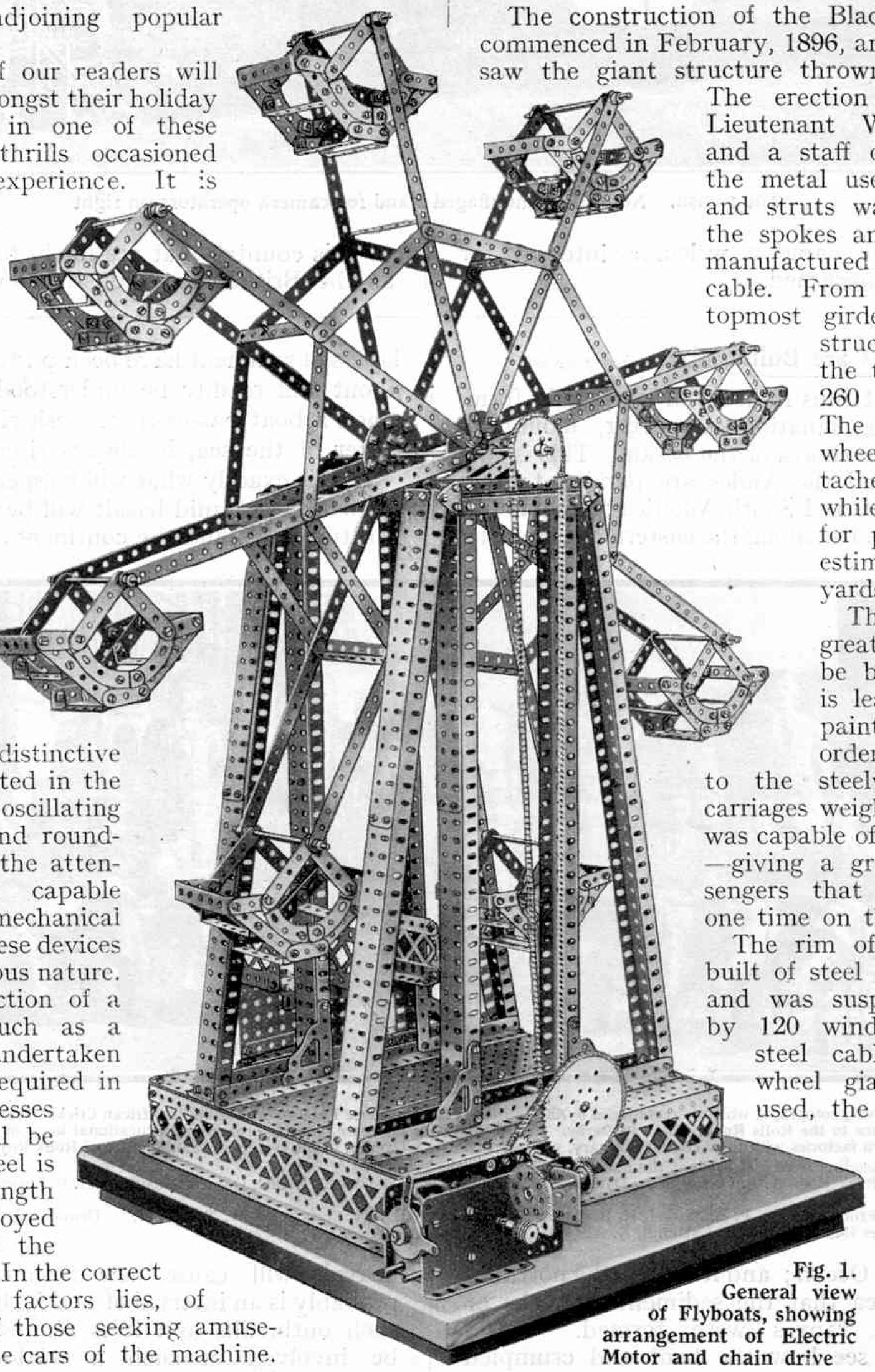


Fig. 1. General view of Flyboats, showing arrangement of Electric Motor and chain drive

ference of which measured 6 feet 10 inches, the axle having a weight of 30 tons!

Although the Meccano model Flyboats differ in some respects from the structural design of the Blackpool Wheel the underlying principle is the same as that on which most Big Wheels and Flyboats are designed. We would refer those boys who wish to build a more accurate model of the Blackpool Wheel to the Meccano Instructions Manual, which contains illustrations and constructional details for building a model that is fashioned to a great extent on this famous pleasure wheel (see Model No. 6.6).

Construction of the Base Frame

It is convenient when constructing a model of this description to commence by building up the base, which is shown in Fig. 2. It is of quite simple design and will give little trouble to the builder. The two $12\frac{1}{2}''$ Angle Girders 1 are bolted to the edges of a $12\frac{1}{2}''$ Braced Girder 2, care being taken to ensure that the flanges of the upper and lower Angle Girders project in opposite directions as indicated in the illustration. Four complete sides are required, and when built these may be bolted together in the form of a square, by means of 2" Angle Girders bolted at each corner. The base is filled in by $3\frac{1}{2}'' \times 5\frac{1}{2}''$ and $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates 5 and 3 respectively and these should be secured rigidly in the positions shown.

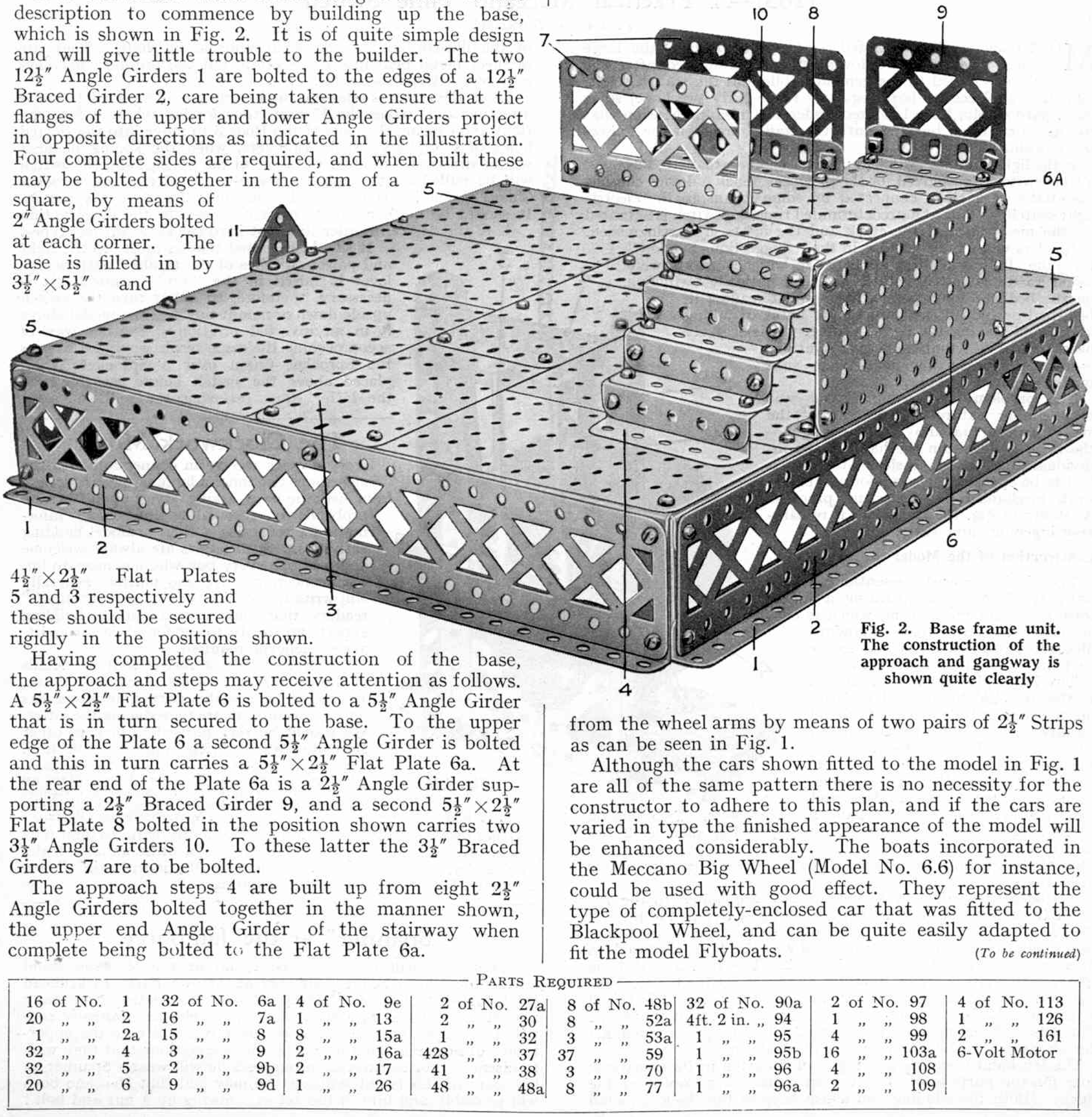


Fig. 2. Base frame unit. The construction of the approach and gangway is shown quite clearly

Having completed the construction of the base, the approach and steps may receive attention as follows. A $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate 6 is bolted to a $5\frac{1}{2}''$ Angle Girder that is in turn secured to the base. To the upper edge of the Plate 6 a second $5\frac{1}{2}''$ Angle Girder is bolted and this in turn carries a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate 6a. At the rear end of the Plate 6a is a $2\frac{1}{2}''$ Angle Girder supporting a $2\frac{1}{2}''$ Braced Girder 9, and a second $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate 8 bolted in the position shown carries two $3\frac{1}{2}''$ Angle Girders 10. To these latter the $3\frac{1}{2}''$ Braced Girders 7 are to be bolted.

The approach steps 4 are built up from eight $2\frac{1}{2}''$ Angle Girders bolted together in the manner shown, the upper end Angle Girder of the stairway when complete being bolted to the Flat Plate 6a.

It will be convenient for the constructor, before commencing to assemble the Main Standards and Wheel Frame, to build up the flyboat cars. These may then be set aside in readiness for the final assembly of all the main units, which will be described next month.

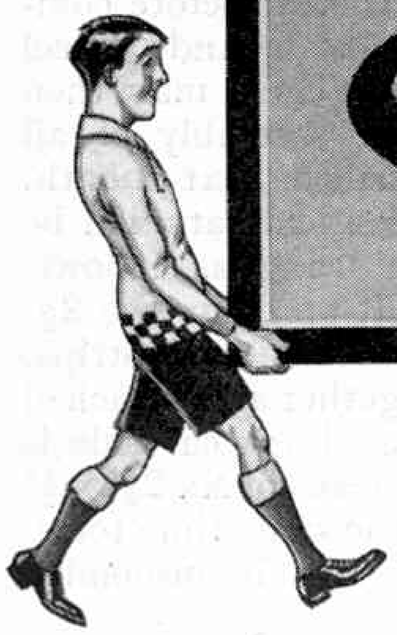
As will be seen in Fig. 1, eight identical cars will be required, the construction of these being as follows. The sides of each of the cars are built-up from two $2\frac{1}{2}''$ Strips joined at their lower ends by means of 2" Strips, while $2\frac{1}{2}''$ Curved Strips are bolted together and attached to the sides by means of $1\frac{1}{2}''$ Strips. Each car side is spaced the correct distance apart by means of six $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, these Strips at the same time forming the seats and back-rests. Each car is suspended from the wheel arms by means of two pairs of $2\frac{1}{2}''$ Strips as can be seen in Fig. 1.

Although the cars shown fitted to the model in Fig. 1 are all of the same pattern there is no necessity for the constructor to adhere to this plan, and if the cars are varied in type the finished appearance of the model will be enhanced considerably. The boats incorporated in the Meccano Big Wheel (Model No. 6.6) for instance, could be used with good effect. They represent the type of completely-enclosed car that was fitted to the Blackpool Wheel, and can be quite easily adapted to fit the model Flyboats.

(To be continued)

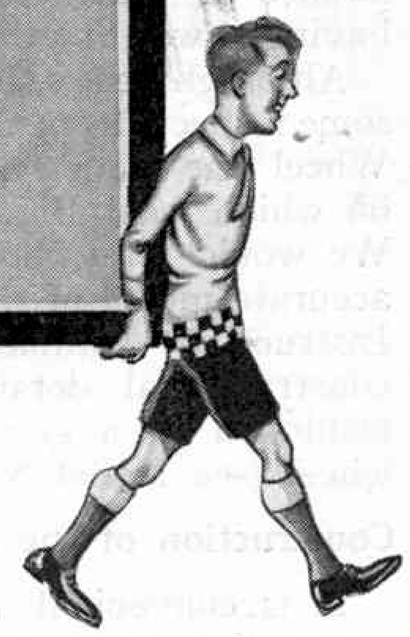
Parts Required

16	of No.	1	32	of No.	6a	4	of No.	9e	2	of No.	27a	8	of No.	48b	32	of No.	90a	2	of No.	97	4	of No.	113
20	„ „	2	16	„ „	7a	1	„ „	13	2	„ „	30	8	„ „	52a	4ft. 2 in.	„	94	1	„ „	98	1	„ „	126
1	„ „	2a	15	„ „	8	8	„ „	15a	1	„ „	32	3	„ „	53a	1	„ „	95	4	„ „	99	2	„ „	161
32	„ „	4	3	„ „	9	2	„ „	16a	428	„ „	37	37	„ „	59	1	„ „	95b	16	„ „	103a	6-Volt Motor		
32	„ „	5	2	„ „	9b	2	„ „	17	41	„ „	38	3	„ „	70	1	„ „	96	4	„ „	108			
20	„ „	6	9	„ „	9d	1	„ „	26	48	„ „	48a	8	„ „	77	1	„ „	96a	2	„ „	109			



Suggestions Section

Edited by "Spanner"



The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(165)—A Practical Meccano Time Switch

(T. Tasker, Barnsley)

MOST readers will have noted the fact that many of the large stores keep their window displays illuminated after the place is closed to the general public and the staff has left, and since all Meccano boys regularly retire early (we hope) some may, pardonably, have laboured under the misapprehension that the lights continue burning until the staff returns on the following morning!

If the lights are not switched off by a night watchman, however, a time switch is employed for the purpose. Such a device consists essentially of a clock connected by some means to the electric light switch, so that at a predetermined time the switch is actuated by the mechanism of the clock and the lights are extinguished.

Readers will remember that in the "Suggestions Section" for June, 1927, a contest appeared in which entrants were asked to design an apparatus for automatically switching off the bedlight for a person who, whilst reading in bed, had developed the unfortunate habit of falling asleep and leaving the light burning. It is scarcely necessary to add that numerous solutions—some extremely ingenious—were submitted by Meccano boys.

The problem confronting Tasker was of a similar nature, but instead of the switch being actuated by a falling weight—the book falling from the hand of the individual dropping off to sleep—the switch had to be operated by some form of clockwork mechanism, as in actual practice. As shown in Fig. 165 the device is remarkably ingenious and yet simple.

Construction of the Model

The device consists essentially of an ordinary alarm clock operating a simple form of trigger mechanism, which is constructed entirely from standard Meccano parts and connected to the switch by a length of Sprocket Chain.

Two 7½" Angle Girders 1 are secured to the 5½" × 2½" Flanged Plate forming the base of the device, additional rigidity being gained by the use of Architraves. The member 2, which slides on the flanges of the Girders 1, consists of two 3½" Flat Girders, which are placed face to face and spaced apart by Washers on the securing bolts. Two tension Springs (part No. 43) are attached to the sliding member 2 and also to a 3½" Strip that is bolted between the Girders 1. The ends of the Springs are attached to the sliding frame by means of ⅜" Bolts.

A Rod 5, journalled in 1½" Strips that are bolted to the 7½" Angle Girders, has secured to it two Couplings carrying the Rods 3. The Couplings are spaced on the Rod 5 so that the Rods 3 may pass freely through the slotted holes of two ½" × ½" Angle Brackets that are secured to the sliding frame 2. The Rod 5 is slidable transversely in its bearings, however, and when setting the mechanism, it is moved slightly to one side and the frame 2 is raised so that the Rods 3 do not coincide with the holes in the Angle Brackets, but instead keep the frame 2 raised by pressing against the Brackets, as indicated in the illustration.

The left-hand Coupling has a ½" Bolt inserted in its transverse bore for the purpose of engaging with the alarm key 4 of the clock. (Both the winding and alarm keys of the clock depicted in the illustration are somewhat unusual in shape. They are of sheet metal bent into a U-section, but the ordinary flat keys may be used just as easily).

When the alarm is released, the key rotates in an anti-clockwise direction and strikes the ½" Bolt, thus forcing the Rod 5 to the right and causing the ends of the Rods 3 to move into the slotted holes of the ½" × ½" Angle Brackets, when the sliding member will be drawn down under the force of the Springs and the switch will be pulled off through the medium of a length of Sprocket Chain, which is attached to the member 2 and to the switch. It should be quite a simple matter to modify the construction of the device in order to adapt it to clocks of various types.

It should be noted that in most electric light and power switches of the tumbler pattern, the lever is raised in the "off" position. It is necessary, therefore, to either turn the switch upside-down or mount the Meccano model above it in an inverted position. Another way of accomplishing the same result would be to pass the Sprocket Chain over a Sprocket Wheel placed above the switch before securing it to the latter, thus reversing the pull.

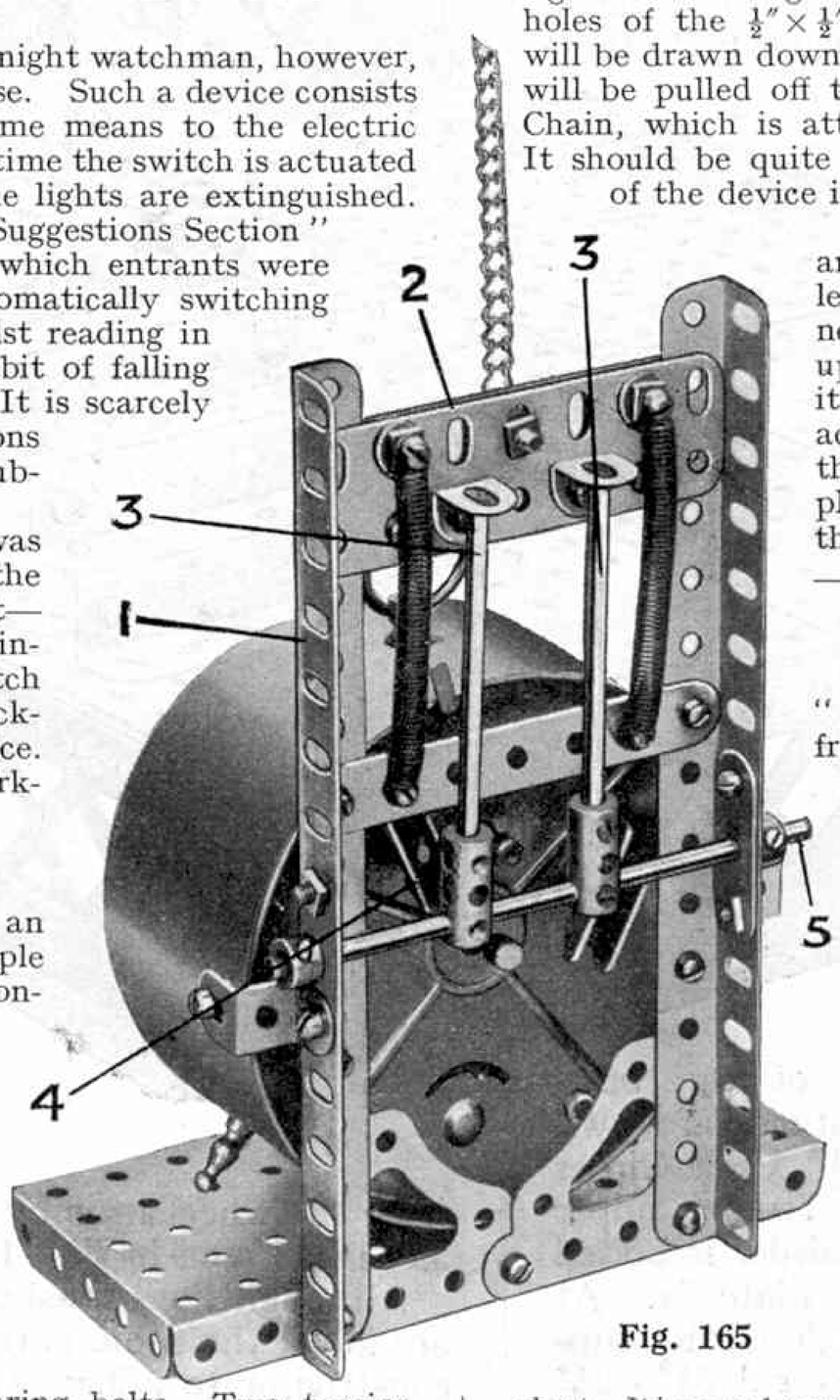


Fig. 165

The Clockwork Motor

Every day we receive in connection with the "Suggestions Section" a large number of letters from Meccano boys, asking advice upon Meccano problems or forwarding interesting information regarding their model-building activities. Such letters are always welcome and we hope every boy who has news to impart concerning Meccano matters generally will write to us. We would remind "*M.M.*" readers that our staff of model-building experts are ready to render advice or assistance whenever required.

A few days ago a reader sent us details of the performance of his Clockwork Motor, and as we believe this particular Motor has set up a record, we are reproducing the letter. We should be very pleased to hear of other Meccano boys' experiences in this connection.

"I am very pleased with the way our Meccano Clockwork Motor has behaved. It is now six years old and has only had one new spring put in and has been repaired once only, although it has had a great deal of knocking about. It is as good as new." J. A. W. (Northwood, Middx.).

Other owners of Clockwork Motors frequently write to inform us of exceptional loads raised by their Motors or other unusual feats. One reader, for example, tells us that his Motor will raise 45 lbs. through a height of 1" at a single winding.

"Spanner" at the Jamboree

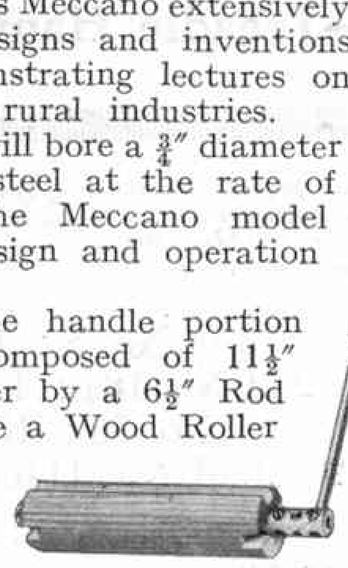
"Spanner" will frequently be found at the Meccano stand during the World Scout Jamboree at Arrowe Park, Birkenhead (31st July–17th August). He looks forward to meeting there many new Meccano boys, as well as old friends who have already contributed suggestions, and he hopes everyone will take the opportunity of bringing along new ideas and suggestions that they wish to discuss. For identification purposes he will wear a Spanner on his coat; if this is not sufficient we may add that Meccano boys will probably find him in the act of screwing up a nut and bolt!

(166)—A New Brace and Bit

Fig. 166 shows a particularly novel brace and bit designed for drilling through metal with a minimum effort on the part of the operator. It is the patented invention of Mr. Joseph Healy of Melksham, Wilts., who uses Meccano extensively in preparing his designs and inventions and also for demonstrating lectures on farriery and other rural industries.

The actual brace will bore a $\frac{3}{4}$" diameter hole through mild steel at the rate of $\frac{1}{8}$" per minute. The Meccano model should make its design and operation quite clear.

In the model the handle portion of the brace is composed of $11\frac{1}{2}$" Rods joined together by a $6\frac{1}{2}$" Rod and Couplings, while a Wood Roller (part No. 106) placed on the $6\frac{1}{2}$" Rod forms a grip. A Coupling 2 is secured to one of the $11\frac{1}{2}$" Rods as shown and a Threaded Pin is secured in its longitudinal bore. This Pin screws into the Threaded Coupling 3; hence the handle may quickly be attached or removed.



The Coupling 3 is mounted on a short Rod and the latter is journalled in two $7\frac{1}{2}$" Angle Girders and in a Bush Wheel. The Girders are bolted together to form a channel-section girder and the Bush Wheel is secured to them by $\frac{3}{4}$" Bolts.

An 8" Threaded Rod 5 is secured by double nuts to each end of the $7\frac{1}{2}$" Girders, and over the other ends of these Rods the cross piece, or yoke 7 is passed.

The drill is fastened in the Coupling 4. The yoke 7 is inserted behind the work and at the same time the Rods 5 are passed through its end holes. Compression Springs are then placed on the Rods and lastly Threaded Bosses 6 are screwed on so that the Springs press the yoke and consequently cause the drill to bear against the work. It is necessary to adjust the feed screws 6 only occasionally as drilling proceeds, because the Springs help to feed the drill into the material.

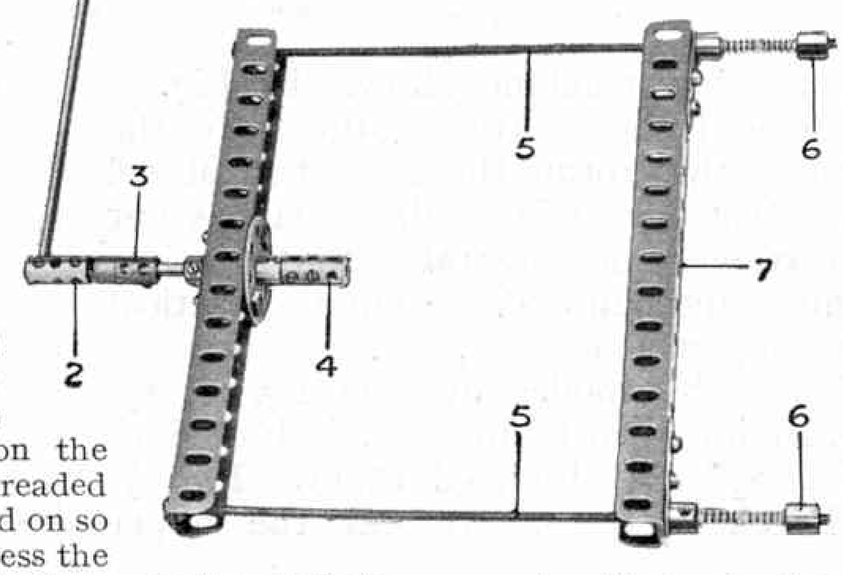


Fig. 166

(167)—Electric Solenoid-operated Brake

(Henry Tizzard, Bath)

The solenoid-operated brake shown in Fig. 167 is in electrical connection with the Motor and functions immediately the current supply is cut off. Such a brake would prove useful as a safety measure in model lifts, cranes, etc.

A 1" fast Pulley 1 shod with a Rubber Ring (part No. 155) is secured to a Rod driven off the armature spindle through suitable gearing. Two 1" fast Pulleys 2 are fastened rigidly to $1\frac{1}{2}$" Strips which are attached pivotally by lock-nuts at their upper extremities to 2" Strips 3, and at their lower ends are mounted loosely on lock-nutted bolts attached to the side plates of the Motor. The other ends of the links 3 are attached pivotally to the 2" Slotted Strip 4, the slot in which engages with the shank of the $\frac{3}{8}$" Bolt 4a. The Strip 4 also is attached to a lever consisting of a $4\frac{1}{2}$" Strip that is connected to the plunger of the solenoid 5. As will be seen from the illustration, this lever pivots about a lock-nutted bolt secured to a Trunnion on the Motor.

The solenoid 5 consists of a Meccano Bobbin wound with four layers of 23 S.C.C. Wire. One end of the finished coil is taken to the insulated terminal 6 and the other is connected directly to the frame of the model. One of the Motor terminals also is connected to the frame, the remaining one being connected to one Accumulator terminal, while the terminal 6 is connected to the other terminal of the Accumulator.

When the Motor is running the current is flowing through the solenoid, and the plunger is held in the raised position. Immediately the current is switched off the solenoid loses its holding power, and the plunger and lever drop down. This causes the short end of the lever to rise, bringing the Pulleys 2 to bear against the Rubber Ring and so applying the brake.

The weight of the lever and of the plunger attached to its longer arm is sufficient to cause the fixed Pulleys to produce a considerable braking effect on the rubber-shod Pulley 1. A maximum effect is obtained, of course, when the Pulley 1 revolves at a high speed relative to the Motor armature; in the mechanism illustrated the gearing between the two consists of a Sprocket Chain engaging between a $\frac{3}{4}$" Sprocket Wheel on the armature shaft and a 1" Sprocket Wheel on the Rod of the Pulley 1.

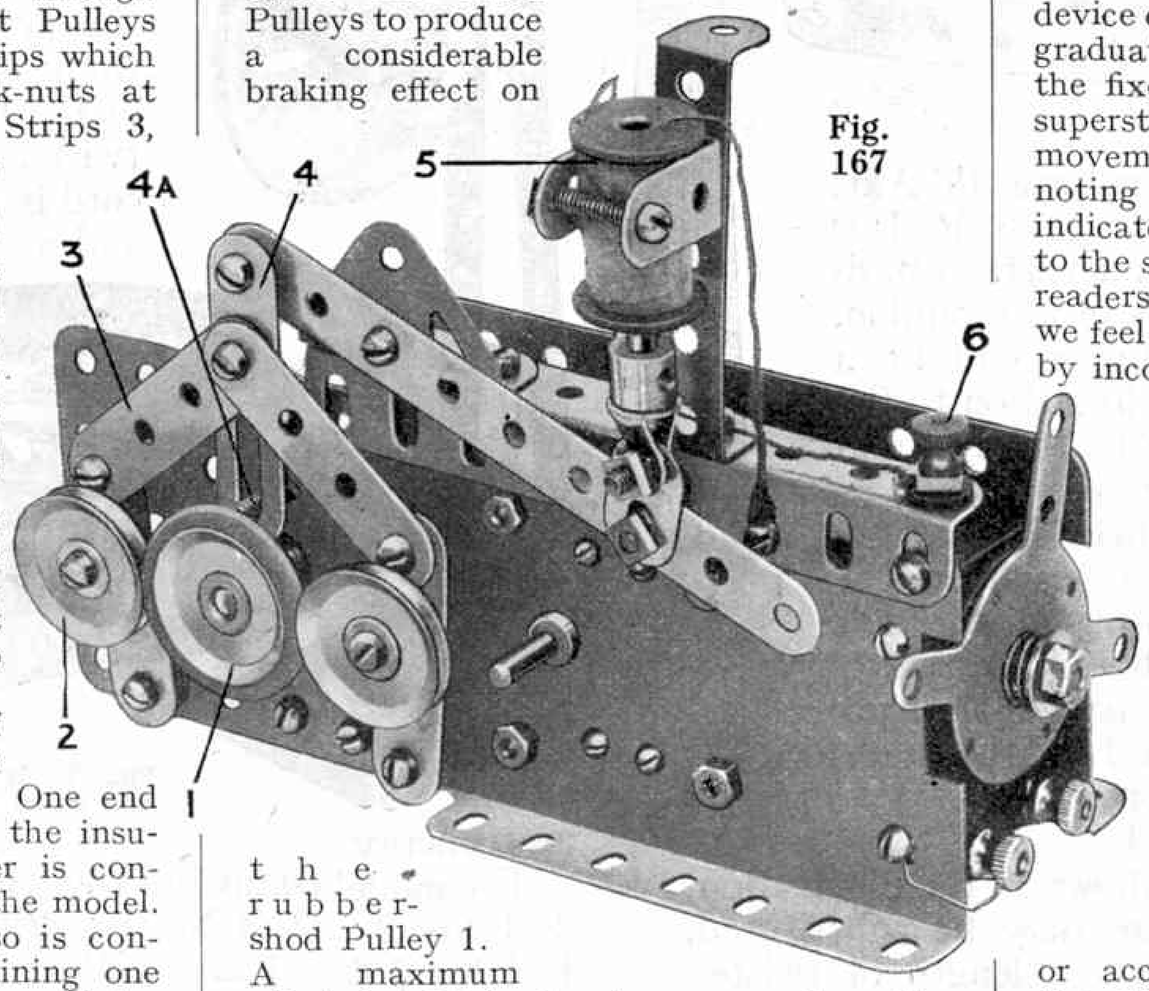


Fig. 167

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.58). Novel Winding System for Cranes.—The following novel method of arranging a crane purchase, suggested by P. Troddyn, Dublin, is worthy of special attention. The Rod taking the drive from the Motor carries a 57-teeth Gear that meshes with a $\frac{1}{2}$" Pinion on a second Rod. One end of the hoisting cord is wound on one of the Rods. The cord is then passed through the single-sheave pulley block and its other end is attached to the other Rod. On setting the device in motion, it will be found that one portion of the cord will be hauled in and the other paid out, although at different rates. This gives a powerful purchase effect without the usual multiplication of sheaves in the pulley system. The principle is of course very ancient, and a similar arrangement was explained on page 8 of the 1928 "Standard Mechanisms" Manual. This is the first instance that has been brought to our notice, however, of its application to a Meccano Crane.

(M.59). Additions to the Pontoon Crane.—Two particularly interesting fittings have been added recently to the Meccano Pontoon Crane (Instruction Leaflet No. 28) by F. Hitch of Gosport. One is a radius indicator on the jib (see Suggestion No. 79, April, 1927), and the other a device that registers the angle of slew. This device consists essentially of a dial suitably graduated and connected by gearing to the fixed central pivot so that when the superstructure rotates, the amount of movement is indicated on the dial. By noting the readings on the scales of both indicators, loads may quickly be conveyed to the same spot at each operation. Many readers who have built the crane will, we feel sure, gain much additional pleasure by incorporating Hitch's suggestion.

(M.60). Warning for Clockwork Motor.—A distinctly novel addition to the Clockwork Motor is suggested by P. Carment (Golders Green, N.W.11), who has fitted his Motor with an electrical warning device for indicating when the spring is nearly unwound. The idea consists principally of a short piece of wire that is secured to an insulated bolt and which touches the spring when the latter has expanded to a certain degree. This completes an electric circuit, the current passing from the battery or accumulator through the frame of the Motor and through the insulated bolt to a lamp or bell.

(M.61). A Useful Tool.—A handy tool is described by E. Heneage (Harrogate). It is a scraper made by bolting a disused safety razor blade to a handle built up from Meccano Strips. It should help to solve the problem of the disposal of old blades!

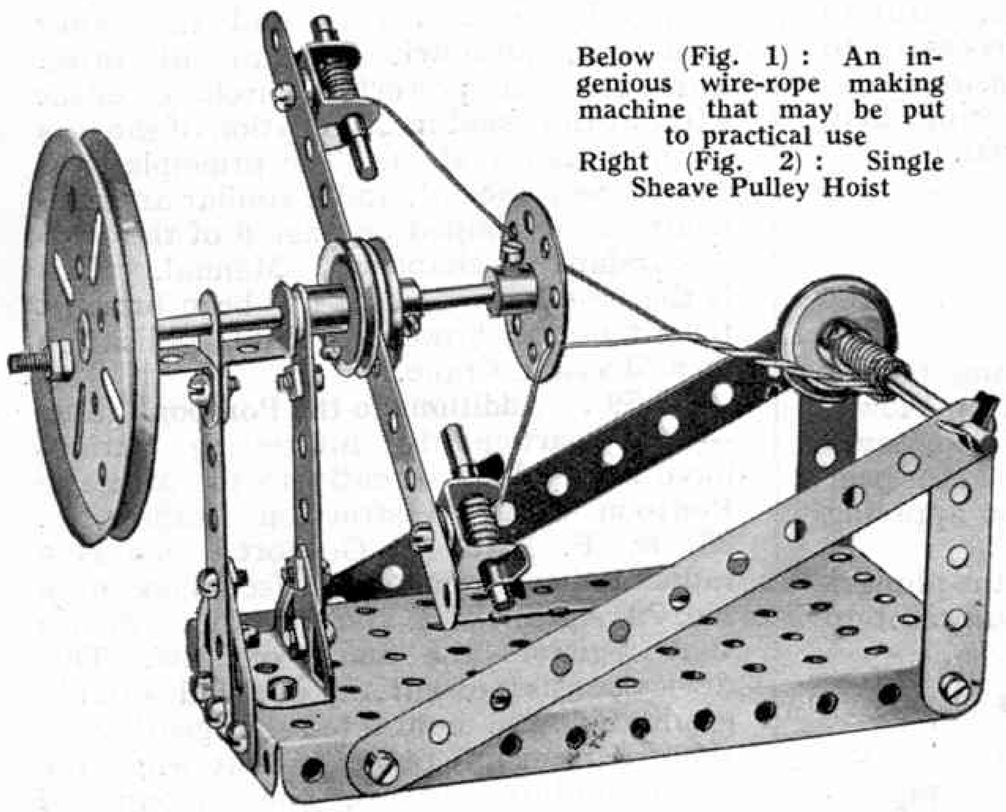
New Meccano Models

Wire-Rope Making Machine—Emery Wheel—Saw Bench—Treadle Hammer, etc.

Since its commencement in the January, 1928, "M.M.," the series of articles entitled "New Meccano Models" has proved remarkably popular amongst model-builders of all ages. The number of entirely new and original models that have been shown so far, including the examples illustrated this month, is 113! Meccano boys who attempt the construction of these interesting models will pass many happy hours, and they will have the added satisfaction of knowing that they are opening up for themselves new possibilities and ideas for future constructional work.

THE wire-rope making machine shown in Fig. 1 may be considered the "little brother" to the large rope-maker that forms the subject of Model No. 4.43 in the 4-7 Instruction Manual. Small as our example is, it nevertheless demonstrates the principle of the actual machine, and can even be put to practical use in making cord or miniature "rope."

Commence building the model by securing a $3\frac{1}{2}$" Strip to a Flat Trunnion, which, in turn, is bolted to the end flange of a $5\frac{1}{2}$"×$2\frac{1}{2}$" Flanged Plate. Two $\frac{1}{2}$" Reversed Angle Brackets are secured at the upper



Below (Fig. 1): An ingenious wire-rope making machine that may be put to practical use
Right (Fig. 2): Single Sheave Pulley Hoist

end of the Strip to form bearings for a $3\frac{1}{2}$" Axle Rod, and a further support for the Rod is formed from a $2\frac{1}{2}$" Strip held in a vertical position on the base plate by means of a Trunnion. The Strip is extended at its upper end by a Flat Bracket. A $5\frac{1}{2}$" Strip is slipped on to the $3\frac{1}{2}$" Axle Rod, between the two 1" Pulleys, and upon securing the latter as close together as possible, the $5\frac{1}{2}$" Strip will be held firmly.

A Double Bracket is bolted to each end of the $5\frac{1}{2}$" Strip, and a $1\frac{1}{2}$" Rod is passed through each Bracket to form the "bobbin" on which the wire is wound. The wire is passed through opposite holes in the Bush Wheel and secured to a $3\frac{1}{2}$" Rod journalled in bearings formed by $5\frac{1}{2}$" and $2\frac{1}{2}$" Strips, as will be seen from Fig. 1.

In place of the Meccano cord shown in the illustration, thin flexible rubber-covered wire may be substituted, which, twisted together will form a length of twisted double flex. Flex of this type is particularly useful in the construction of electrical models, and those Meccano boys who are radio "fans" will know that in the formation of battery and loud speaker leads, a multiple wire cable is invaluable.

The following parts are required to build this model :—3 of No. 2; 1 of No. 3; 3 of No. 5; 1 of No. 10; 2 of No. 11; 2 of No. 16; 2 of No. 18a; 1 of No. 19b; 3 of No. 22; 1 of No. 24; 6 of No. 35; 16 of No. 37; 2 of No. 37a; 1 of No. 52; 1 of No. 111c; 1 of No. 126; 1 of No. 126a.

Single Sheave Pulley Hoist

The model shown in Fig. 2 is interesting in that it makes use of a well known principle in mechanics—the gaining of a mechanical advantage by transmitting power through a system of pulleys.

Two $12\frac{1}{2}$" Strips are bolted on each side of a $5\frac{1}{2}$"×$2\frac{1}{2}$" Flanged Plate, $2\frac{1}{2}$" Curved Strips being bolted to their upper ends and two $2\frac{1}{2}$" Strips are bolted, in turn, to the curved Strips and supported by means of $5\frac{1}{2}$" Strips.

In this instance, a mechanical advantage of 2 is obtained, or in other words, if the 3" Pulley shown hanging from the hook weighs 2 ozs., then, theoretically, a force of only 1 oz. need be applied to the Crank Handle in order to raise the load. Do not think, however, that by using this system we can obtain "something for nothing"! The raising of the Pulley in this manner takes twice as long as when the hoisting cord is attached to the load direct, and as "energy" is the resultant of the applied force multiplied by time, we do not actually gain any energy.

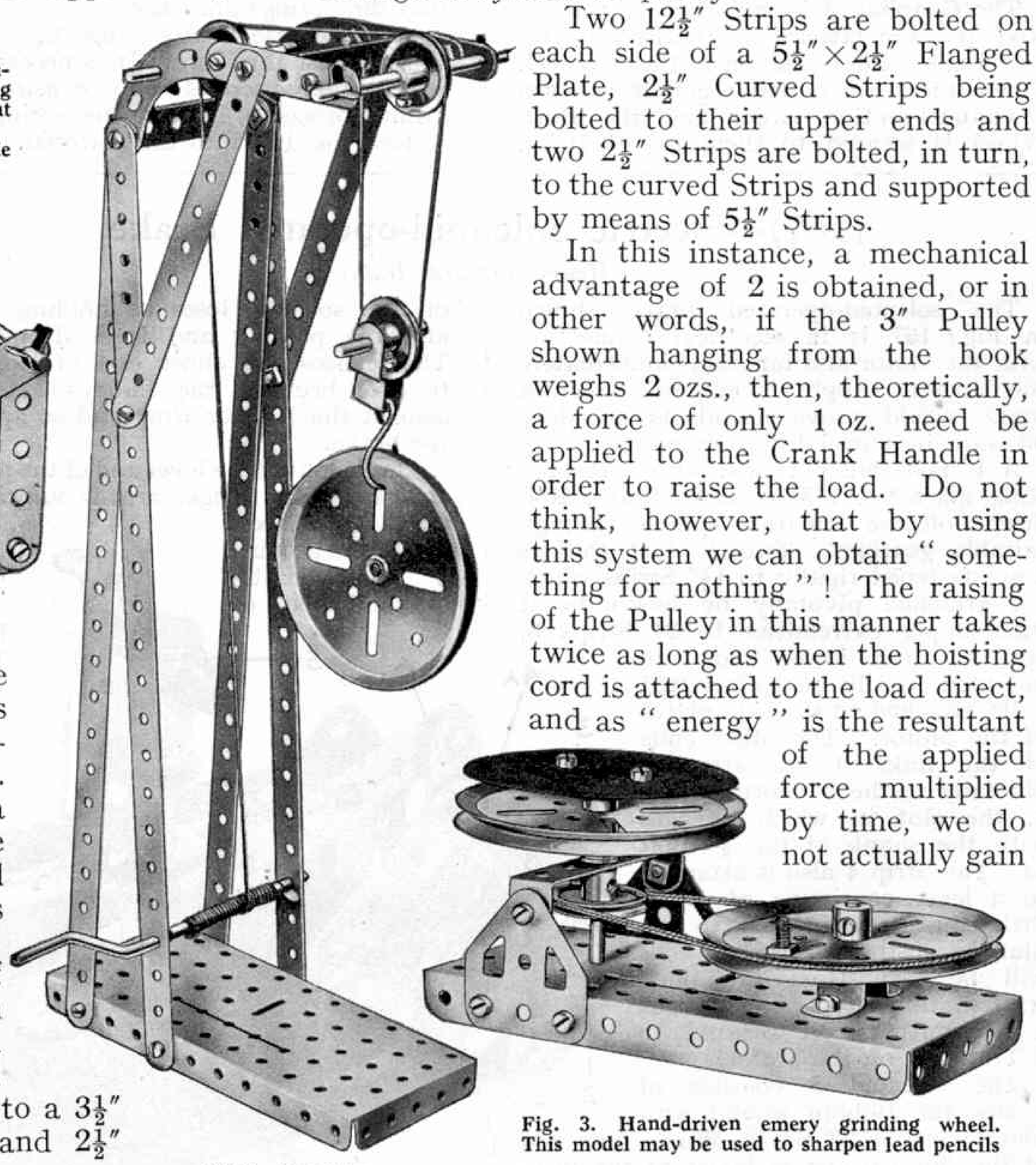


Fig. 3. Hand-driven emery grinding wheel. This model may be used to sharpen lead pencils

The model comprises the following parts :—4 of No. 1; 2 of No. 2; 2 of No. 5; 2 of No. 16; 1 of No. 18a; 1 of No. 19b; 1 of No. 19s; 3 of No. 22; 8 of No. 35; 14 of No. 37; 1 of No. 40; 1 of No. 44; 2 of No. 48a; 1 of No. 52; 1 of No. 57; 2 of No. 90a.

Hand-driven Emery Grinding Wheel

Those readers who wish to obtain a really fine point on their drawing pencils should build the emery wheel

shown in Fig. 3. It should also be possible to carry out other light grinding work with the aid of the device.

The base of the model consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. Two Flat Trunnions are bolted to this, and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is secured between them to form a bearing for a 2" Axle Rod carrying a 1" and a 3" Pulley. A Bush Wheel is secured to the upper end of the Rod, and to this a disc of stiff emery paper is bolted.

To construct this useful little model the following parts are needed :—1 of No. 17 ; 1 of No. 18a ; 2 of No. 19b ; 1 of No. 22 ; 1 of No. 24 ; 2 of No. 35 ; 10 of No. 37 ; 1 of No. 45 ; 1 of No. 48a ; 1 of No. 52 ; 1 of No. 111c ; 1 of No. 126a ; Disc of emery paper 3" diameter.

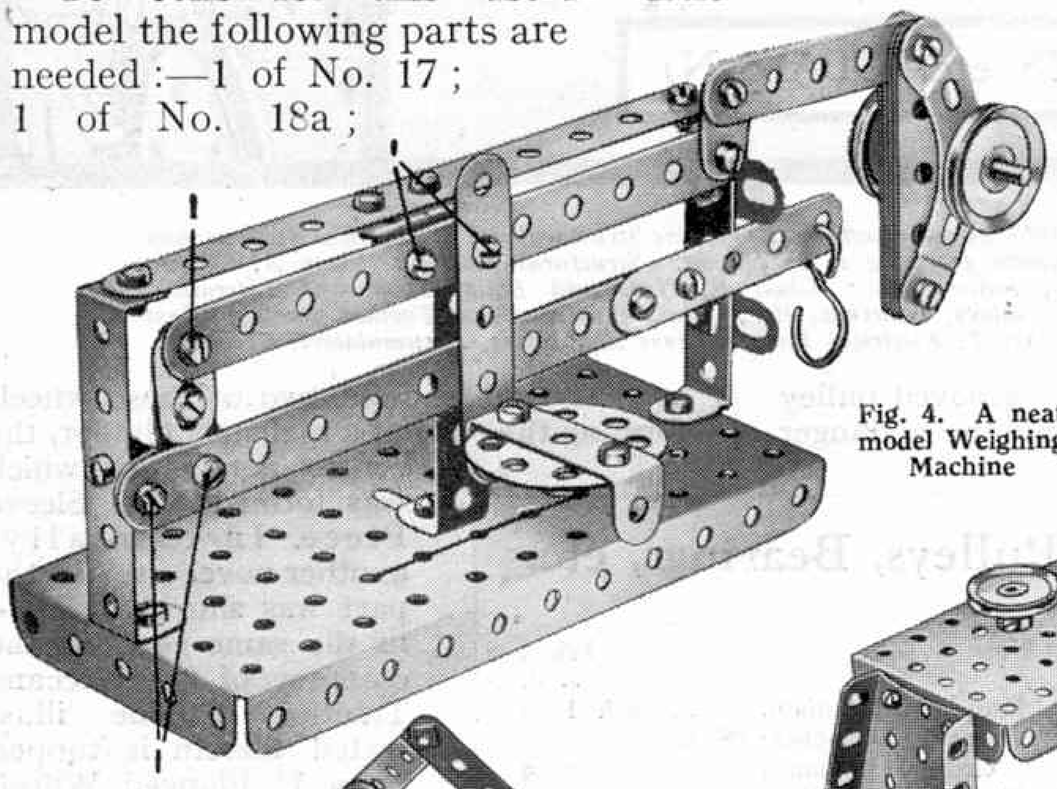


Fig. 4. A neat model Weighing Machine

An Interesting Weighing Machine

In large factories where many thousands of a single type of article are manufactured daily, the task of keeping an accurate check on production becomes a difficult one.

In the Meccano factory, for instance, the average number of $5\frac{1}{2}''$ Strips that are punched out each day is in the neighbourhood of 200,000 ! It is obvious therefore that even the most competent store keeper cannot be expected to count each individual Strip ! Consequently special weighing machines are employed, and the model shown in Fig. 4 is a reproduction of one of these machines. It consists of a system of compound levers arranged so that a weight placed on the Hook exerts a much greater " purchase " than a weight placed on the Bush Wheel forming the scale pan of the weighing machine.

To build the Meccano model, three $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, a $5\frac{1}{2}''$ Strip being secured across their upper ends, and Angle Brackets are bolted to the framework so formed to carry the pivots of the levers.

A $5\frac{1}{2}''$ Strip is pivoted in the fifth hole from one end and extended at the longer end by means of a $2\frac{1}{2}''$ Strip secured by a Flat Bracket. To the extremity of this lever a balance weight consisting of a number of Strips and Pulleys is also attached. At the other end of the lever a Flat Bracket is lock-nutted and connected pivotally by a second Flat Bracket to a $5\frac{1}{2}''$ Strip. The latter is extended to 7" by a $2\frac{1}{2}''$ Strip. All the bolts 1 act as pivots, each being lock-nutted (see Standard Mechanism No. 262).

The scale pan consists of a Bush Wheel supported by a $2\frac{1}{2}''$ Strip, the lock-nut pivot mechanism again being used. The " moment " or " purchase " of a weight placed upon the Hook is approximately 52 times greater than that of a similar weight placed on the Bush Wheel. With the aid of the model and a number of small Meccano parts, such as Washers or Bolts it is possible to carry out several interesting experiments.

The following list shows the parts required in the construction of the model :—3 of No. 2 ; 9 of No. 5 ; 5 of No. 10 ; 2 of No. 12 ; 1 of No. 18a ; 2 of No. 22 ; 1 of No. 24 ; 22 of No. 37 ; 7 of No. 37a ; 1 of No. 48 ; 3 of No. 48a ; 1 of No. 52 ; 1 of No. 57 ; 2 of No. 90a ; 2 of No. 111c.

Hand Operated Saw Bench

The saw bench fitted with circular saw has always been a popular subject with model builders especially since the addition to the Meccano system of a tempered steel Circular Saw (part No. 159). The model shown in Fig. 5 can be built with a No. 1 Outfit, and uses a Bush Wheel to represent the saw, but if a Circular Saw is available, so much the better !

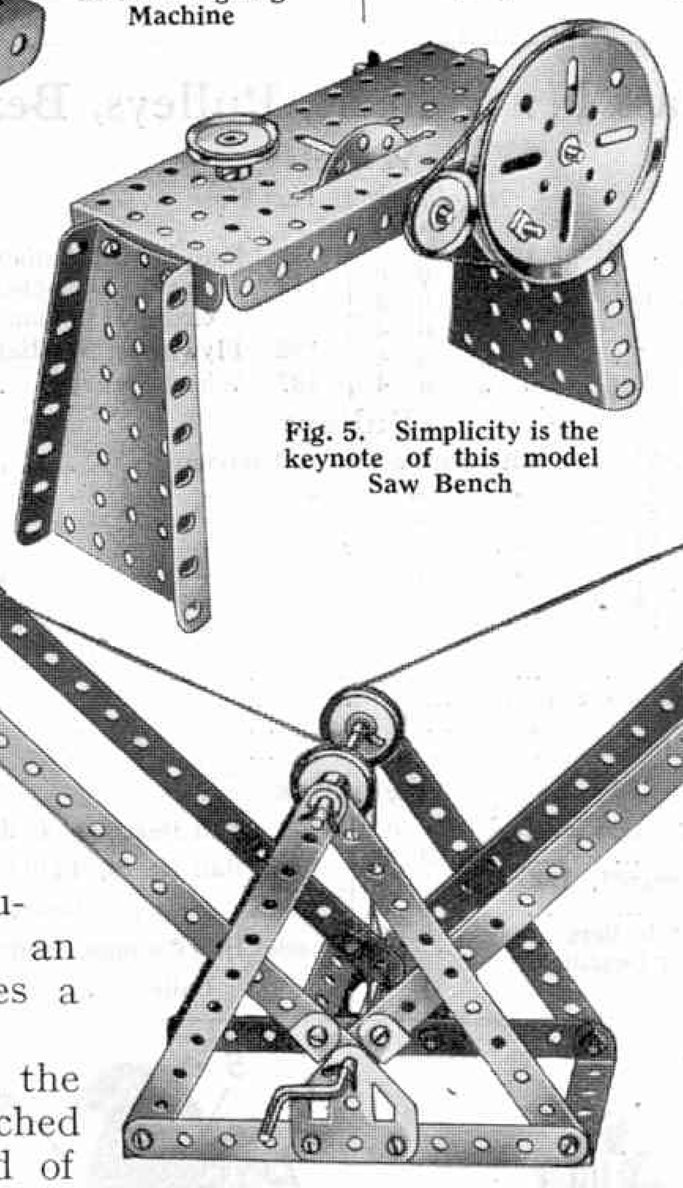


Fig. 5. Simplicity is the keynote of this model Saw Bench

A Sector Plate is bolted to each end of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate to form the bench, the saw being mounted on a $3\frac{1}{2}''$ Rod so that it protrudes through the longitudinal slot cut in the Plate (new style).

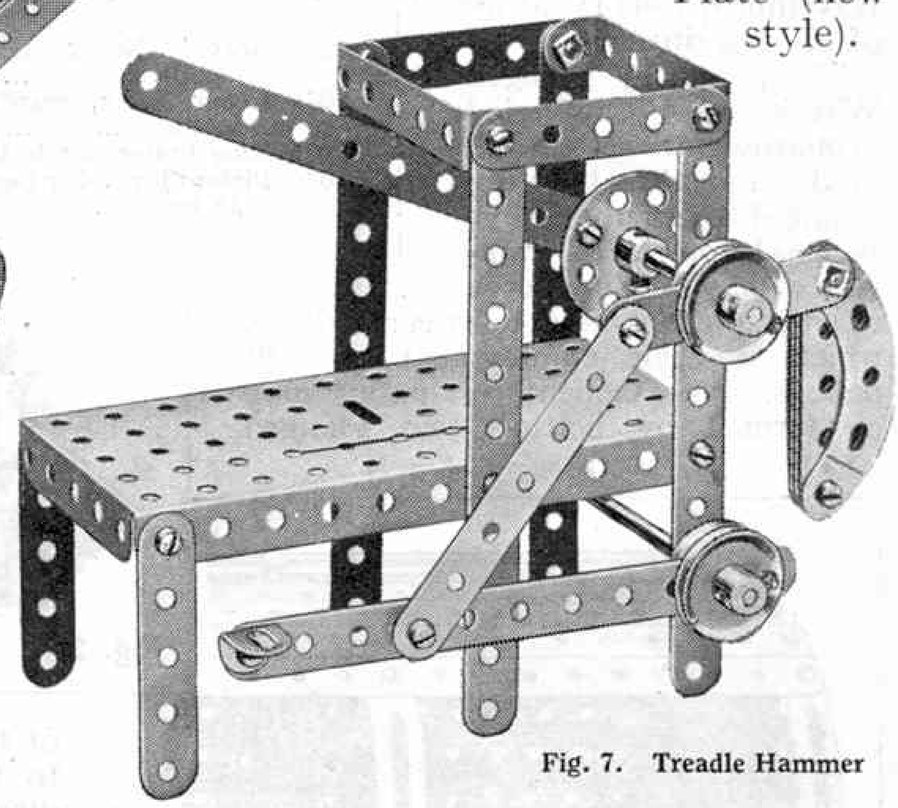


Fig. 6. Jack-knife Bridge with movable bascules

Fig. 7. Treadle Hammer

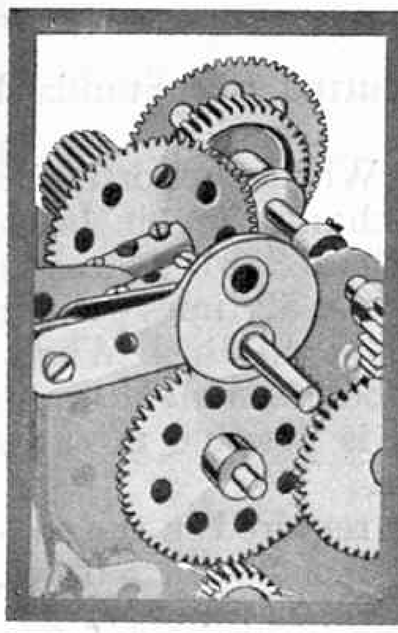
A 1" Pulley that is secured to the shank of a $\frac{3}{8}''$ Bolt passed through the Flanged Plate, serves as a guide when the material is being fed to the saw blade.

The following parts are required for the Saw Bench :—2 of No. 16 ; 1 of No. 19b ; 2 of No. 22 ; 1 of No. 24 ; 3 of No. 35 ; 4 of No. 37 ; 1 of No. 37a ; 1 of No. 52 ; 2 of No. 54 ; 2 of No. 111c.

Working Model Jack Knife Bridge

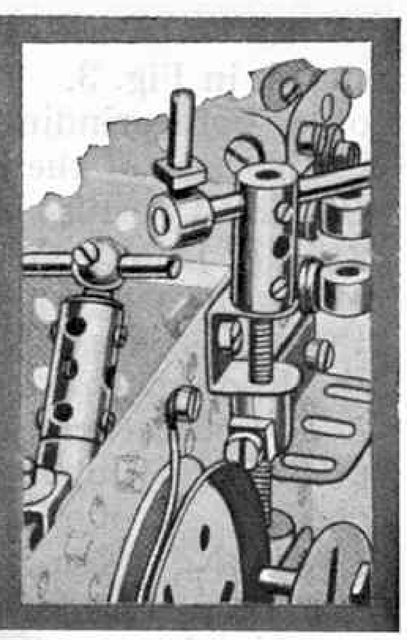
The model illustrated in Fig. 6 represents a type of bridge that will be well-known to the majority of American model-building enthusiasts.

The base of the Meccano model (Continued on page 627)



HOW TO USE Meccano Parts

VII.—WHEELS, PULLEYS, etc. (CLASS N)



For the purpose of this series of articles we have grouped all the Meccano parts into two main sections, termed the Structural and Mechanical Sections, and these sections have been further divided into a number of separate classes. The complete grouping is as follows. Structural Section: Class A, Strips; Class B, Girders; Class C, Brackets, Trunnions, etc.; Class D, Plates, Boilers, etc.; Class E, Nuts and Bolts, Tools and Literature. Mechanical Section: Class M, Rods, Cranks and Couplings; Class N, Wheels, Pulleys, Bearings, etc.; Class O, Gears and Toothed Parts; Class P, Special Accessories; Class Q, Miscellaneous Mechanical Parts; Class T, Electrical Parts; Class X, Motors, Accumulators, etc.

THE parts grouped under Classes N and O comprise some of the most interesting and important components of the Meccano system, for they form the means whereby a model may be set in motion. It is a thrilling moment when, having completed the main structural portions, one proceeds to insert the Gears, Pulleys, etc. that will enable the model to function exactly like its prototype.

The Meccano Wheels are extremely varied in design and application. Part No. 19a, 3″ diameter Wheel, has a smooth circumference and is provided with ten spokes. It is intended for use as a travelling wheel in vehicles of all descriptions.

The ¾″ and 1⅛″ Flanged Wheels are intended primarily for use in all kinds of models that are required to run upon rails, such as locomotives, tramway cars, etc. They have other important uses, however, chief of which is their employment as belt pulleys. An excellent belt pulley may be formed by bolting two Flanged Wheels together as shown in Fig. 2. This illustration represents a model governor driven by an endless cord, and the wide belt pulley is used to take the drive because the axis of the driving pulley is horizontal whilst that of the driven pulley is vertical. If an ordinary grooved pulley were employed, there would be a danger of the cord leaving the groove owing to the fact that it would not be in direct line with it.

In Fig. 4 the Flanged Wheels form part of a belt reversing gear. In this case each belt pulley consists of two 1⅛″ Flanged Wheels, and one wheel in each pair is fixed while the other is loose. The mechanism is so designed that while one belt is driving on to a fixed Flanged Wheel the other rides on a loose wheel, and the arrangement may be reversed when desired by slipping each belt simultaneously from one Flanged Wheel to the other.

An important adaptation of the ¾″ Flanged Wheel was described in connection with the Sleeve Piece (Class D) in the May, 1929, "*M.M.*" An illustration in that issue showed two of these wheels forming the ends of a realistic cylinder, the centre portion of which was formed by a Sleeve Piece. Incidentally, another novel use for the part was shown in Fig. 4 in the same issue, for the chimney of the Meccano Traction Engine illustrated therein is topped by a ¾″ Flanged Wheel, the boss of which is inserted in the upper Sleeve Piece.

If larger flanged wheels are required they may be built up from existing parts. Fig. 6 shows two sizes of flanged wheels used in a large Meccano locomotive. The bogie wheels of this model each consist of a Wheel Flange bolted to a Face Plate, whilst the main driving wheels are formed from a Hub Disc secured to a Circular Plate (the latter part is grouped under Class D).

In addition to this important adaptation, the Hub Disc is admirably suited to form a flywheel or large travelling wheel. Fig. 7 shows one of the rear travelling wheels of the Meccano Traction Engine, and as will be seen it consists of two Hub Discs bolted together so that a wheel of specially wide tread is obtained. As this model is sometimes called upon to draw very heavy loads, a number of nuts and bolts are inserted round the circumfer-

Parts in Class N: Wheels, Pulleys, Bearings, etc.

Wheels

Part No.		Prices	Part No.		Prices
		s. d.			s. d.
19a	Wheels, 3″ diam. with set screws ... ... each	0 6	118	Hub Disc, 5½″ diam. ... each	1 3
20	Flanged Wheels, 1½″ diam. „	0 5	119	Channel Segments (8 to circle, 11½″ diam.) ... „	0 4
20b	„ „ ¾″ „ „	0 4	132	Flywheels, 2¾″ diam. ... „	2 0
24	Bush Wheels ... ... „	0 4	137	Wheel Flanges ... ... „	0 3
109	Face Plates, 2½″ diam. ... „	0 4			

Pulleys

19b	Pulley Wheels, 3″ diam. with centre boss and set-screw ... ... each	0 7
19c	„ „ 6″ „ „ „ „ „ ... ... „	2 0
20a	„ „ 2″ „ „ „ „ „ ... ... „	0 5
21	„ „ 1½″ „ „ „ „ „ ... ... „	0 4
22	„ „ 1″ „ „ „ „ „ ... ... „	0 3
23a	„ „ ½″ „ „ „ „ „ ... ... „	0 3
22a	„ „ 1″ „ without „ „ „ ... ... „	0 2
23	„ „ ½″ „ „ „ „ ... ... „	0 2
123	Cone Pulleys ... ... „	1 3
151	Pulley Blocks, Single Sheave ... ... „	0 8
152	„ „ Two „ ... ... „	0 9
153	„ „ Three „ ... ... „	1 0

Bearings

		s. d.			s. d.
167	Geared Roller Bearings, complete ... ... each	20 0	168	Ball Bearings, 4″ diam. ... each	3 0
167a	Roller Races, geared, 192 teeth ... ... „	4 6	168a	Ball Races, Flanged ... „	0 6
167b	Ring Frames for Rollers ... „	3 0	168b	„ „ Geared ... „	0 9
167c	Pinions for Roller Bearings, 16 teeth ... ... „	1 0	168c	Ball Casings, complete with Balls ... ... „	1 9

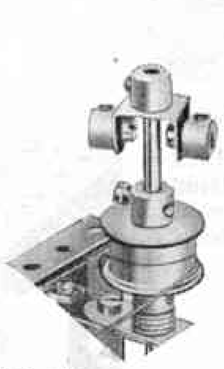


Fig. 2

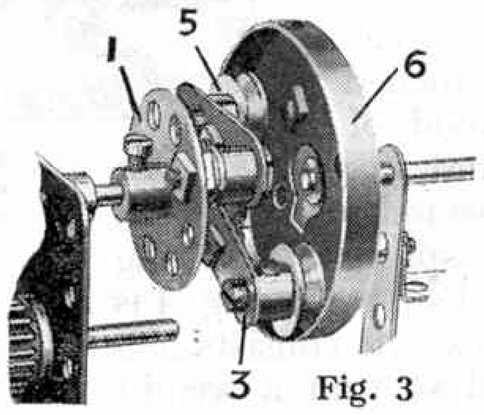


Fig. 3

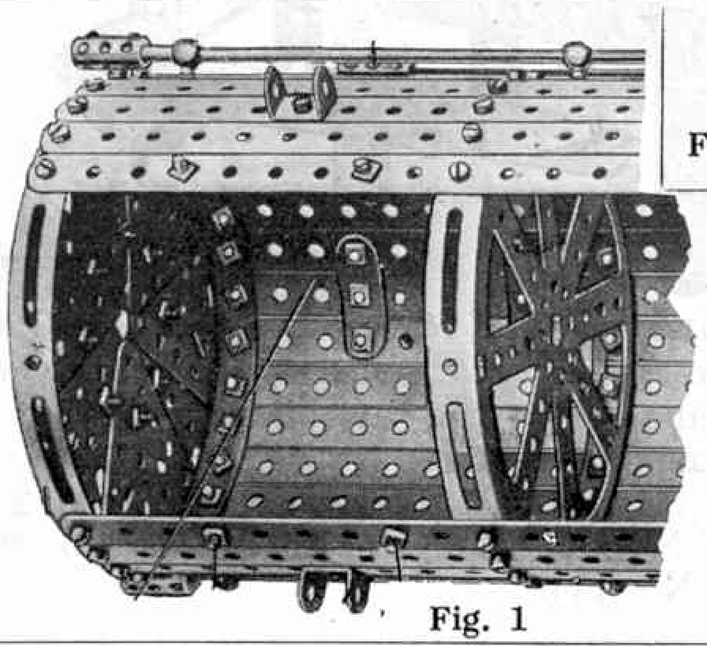


Fig. 1

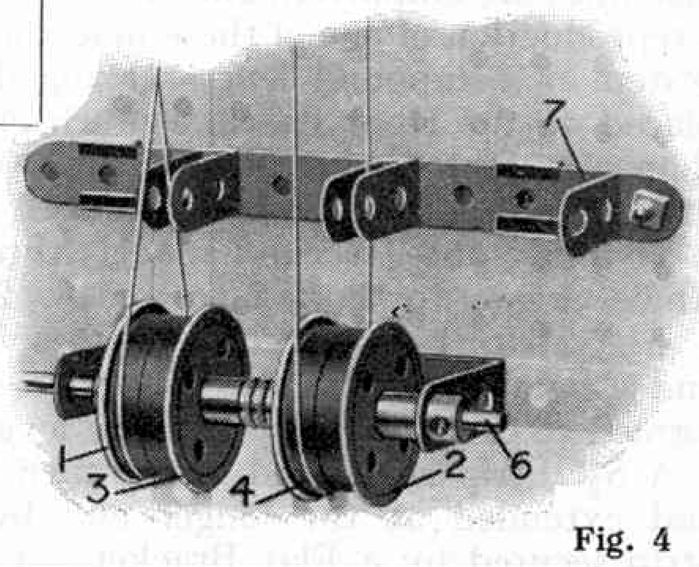


Fig. 4

ence of the Hub Discs to obtain a better grip on the road.

When it is desired to secure a Hub Disc to an Axle Rod it will be necessary first to bolt the Disc to a Bush Wheel or 1½" Pulley, etc., so that the set-screw of the latter may be utilised to grip the Rod. The central hole in the Hub Disc is made of such a diameter that a boss may be passed through it. In Fig. 1 a Hub Disc forms the end plate of a Boiler, while another serves as an internal supporting rib.

The Face Plate also fulfils other functions. Its obvious use is in a lathe, where it serves as a face plate and thereby justifies its name. It is 2½" in diameter and the slots and holes punched in its face enable other parts to be clamped to it. In Fig. 8 two Face Plates are shown employed as a hub for a large built-up flywheel. In the Meccano Grandfather Clock a Face Plate and a few Reversed Angle Brackets form the escapement wheel.

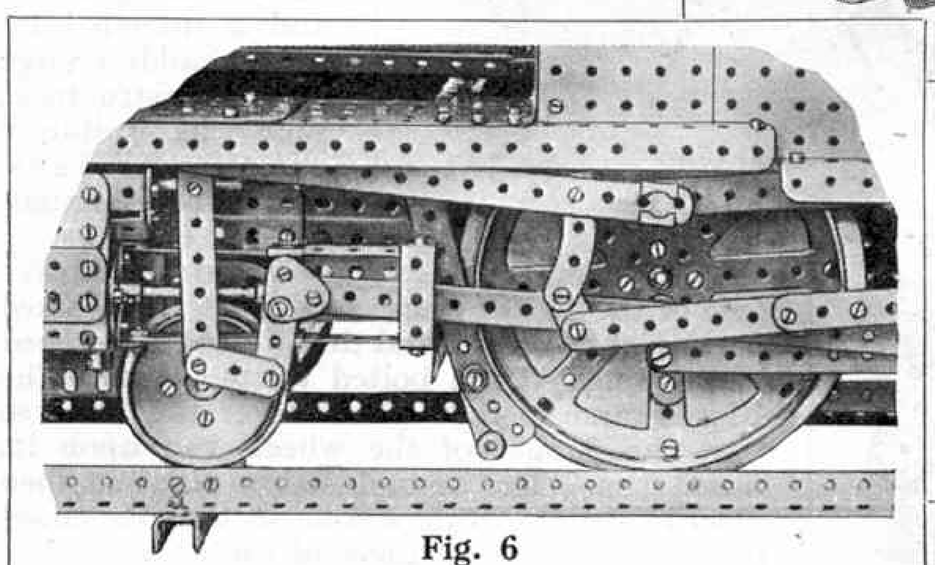


Fig. 6

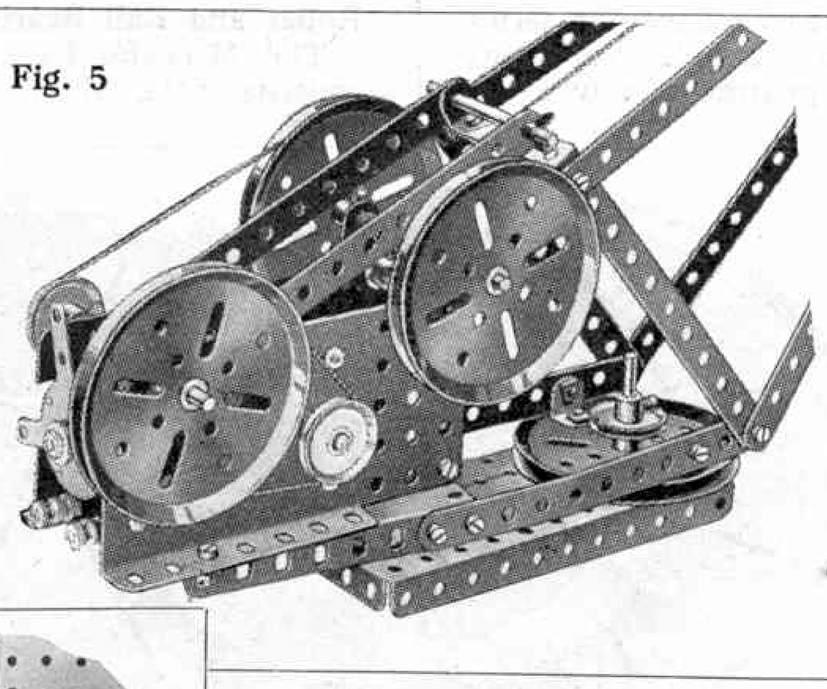
The Wheel Flange, in addition to the use already mentioned, has many widely different adaptations. Fig. 3 shows a Wheel Flange used as part of a centrifugal governor. In this mechanism the governor weights 5, which are attached to short Strips 3 carried on a Bush Wheel 1, fly outward when the latter rotates and press against the inside of the Wheel Flange, so preventing the Bush Wheel exceeding a certain speed limit. In the Motor Chassis Wheel Flanges form the brake drums for the internal expanding brakes on the rear axle.

The functions of the Bush Wheel are too numerous to mention in detail, but the chief are its use as a boss to which other Meccano parts, such as Hub Discs, etc., may be bolted, or as an end plate for a cylinder, etc. In the latter case Double Angle Strips can be used as the sides of the cylinder, and they may be bolted directly to the holes in the face of the Bush Wheel.

The Channel Segments are intended to be bolted together end to end to form a circle or portions of a circle. Eight Segments connected will form a complete circle 11½" in diameter. This can be used as a large flywheel, or as a circular base for rotating structures. Fig. 8 shows a heavy flywheel built up from two circles of Channel Segments connected together and supported by 5½" Strips radiating from a central hub.

The Flywheel (part No. 132) is 2¾" in diameter, weighs 5 oz., and is of lead

Fig. 5



alloy except for the hub and boss, which are of brass. It may be employed wherever it is required to smooth over unequal stresses in rotating machinery. The hub is ½" in diameter and incorporates a groove to receive a belt drive. The circumference of the wheel itself is also provided with a groove, so that an endless cord may be passed round it. The groove is milled or serrated to prevent the cord slipping.

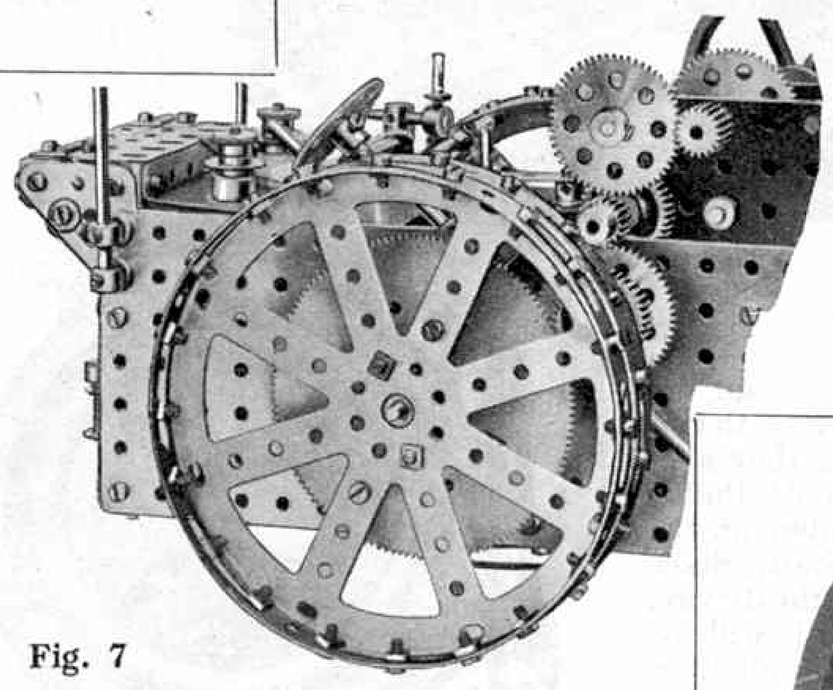


Fig. 7

Other Meccano parts that are used sometimes in the construction of wheels are the Circular Girder (see Class B) and the Circular Strip (Class A).

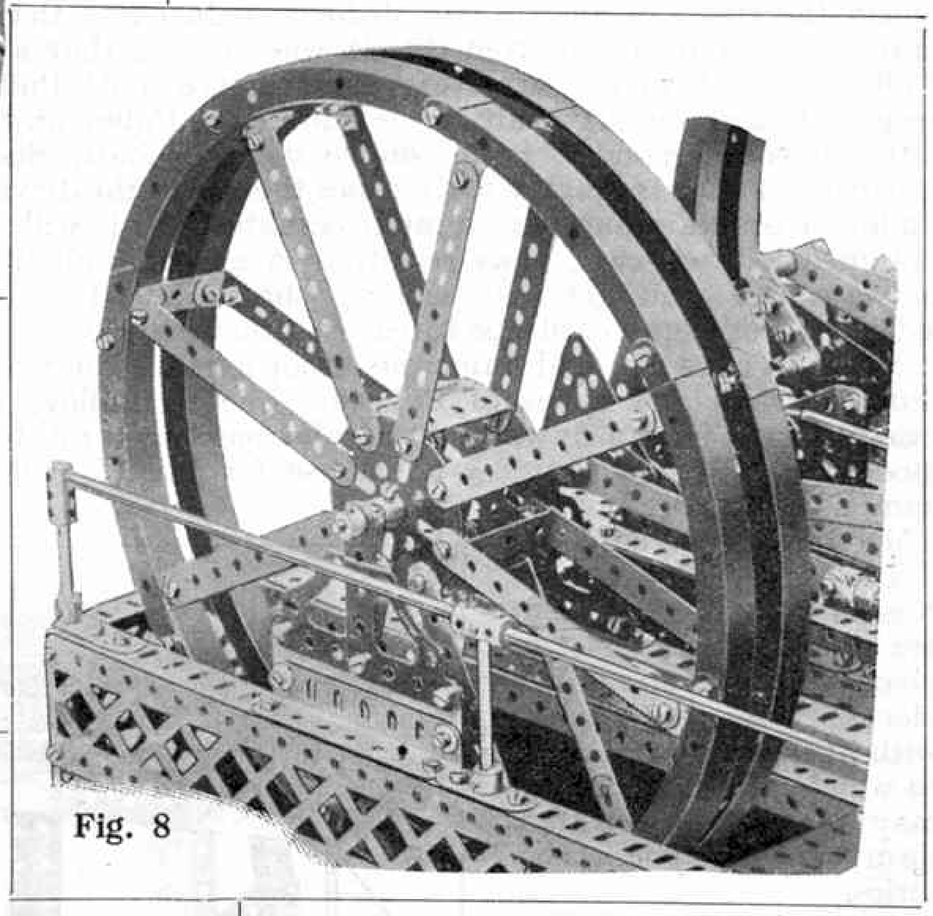


Fig. 8

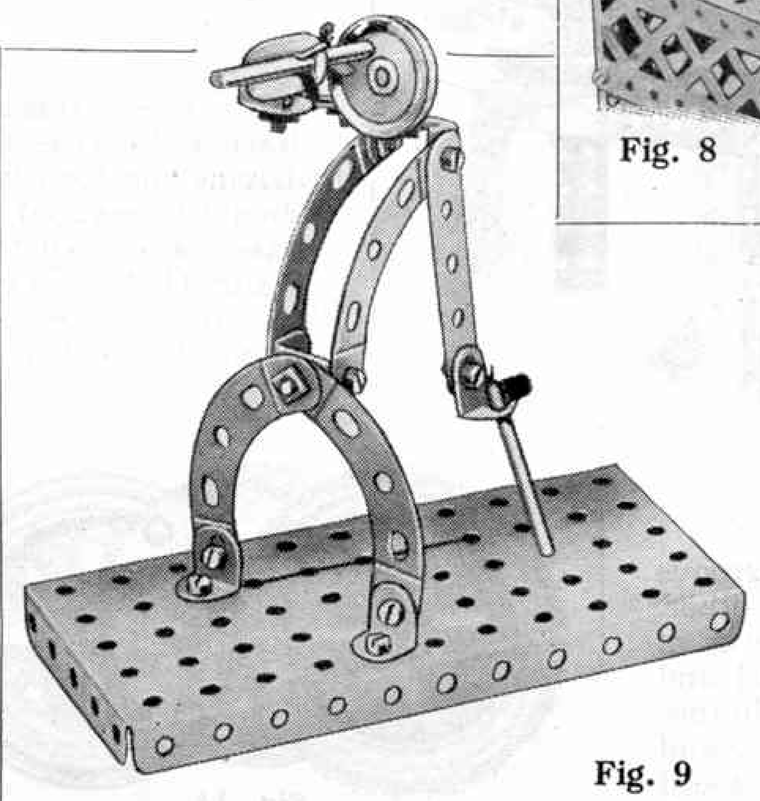


Fig. 9

The Meccano Pulleys

Pulleys form one of the mechanical powers, and by coupling a series of them to a Meccano Motor or even to a Crank Handle, considerable loads may be lifted with comparative ease. It would take up too much space to describe their principles in this article, but it will be useful to remember that pulleys enable a small force to overcome a greater load by reason of the fact that they enable the force to move through a greater distance than the load, just as a lever enables one, by moving one end through a certain distance, easily to raise a heavy load through a smaller distance at the other end.

It must here be explained that a pulley block consists of a frame comprising one or more wheels, or "sheaves," capable of rotating independently, and round which a rope may be passed or "rove." Hence if Meccano Pulleys are employed to construct a model pulley block, they are referred to in technical language as "sheaves."

Supposing a model crane is capable of lifting a load of 1 lb. attached directly to the crane hook, then if the hoisting cord, instead of being attached to the hook, is led round the sheave of a pulley block and taken back and fastened to the jib of the crane, a load of 2 lbs. could be raised with only a very slight increase in the power, this slight increase being necessary to overcome friction created in the pulley block, and in the bending of the cord. The load of 2 lbs. could only be raised at half the speed of the former load, however.

Similarly, if an extra sheave is incorporated in the suspended pulley block and the hoisting cord, after passing round the first sheave, is led back and round another pulley at the jib head, then round the second sheave in the pulley block, and finally is fastened to the jib head, then the crane hook will move at a quarter of its original speed and the crane will be capable of raising a load of 4 lbs. (or slightly less, allowing for friction). If further sheaves are added the load may be increased still further, but always a proportionate amount of

speed will be lost. Hence it will be seen that by means of a series of pulley blocks a Meccano Motor may be caused to lift very considerable loads without the use of toothed gearing of any kind.

Besides their use as sheaves for pulley systems, the Meccano Pulleys may be used as the running wheels of travelling models of all descriptions and, most important function of all, they make possible the construction of belt gearing. Meccano cord may be used for all belt driving purposes in Meccano models but if comparatively light drives only are required, Spring Cord (part No. 58) forms an excellent means whereby power may be transmitted from one Pulley to another. More will be said about the use of Spring Cord in Class Q, in which the part is included.

In preparing endless cords for driving purposes, they should be stretched as tightly as possible between the Pulleys and the ends should be connected together by a reef knot. If there is any possibility of the cord slipping round the groove of the Pulleys the drive should be duplicated.

Pulleys are invaluable for transmitting the drive from a Meccano Motor when gears are not available. Fig. 5 shows a belt system constructed with their aid, by which the speed of an Electric Motor is reduced so that a crane may be operated from it. It will be seen that a 1″ Pulley secured to the armature shaft drives a 3″ Pulley secured to a secondary shaft, while another 1″ Pulley on the latter drives a second 3″ Pulley on the winding shaft. Since the driven pulley is roughly three times the size of the driving pulley a speed reduction of approximately 3 : 1 will be obtained in each case, thus resulting in a total reduction between the armature and winding shaft of 9 : 1. Considerable loads may easily be lifted with this gearing.

Meccano boys will find numerous other uses for the many different sizes and types of Pulleys. The 6″ Pulley, for example, will form a flywheel or circular base for a rotating model, etc. Fig. 9 shows a novel use for the 1″ Pulley, namely, as the head of the "Meccano Coastguard"!

The Pulley Blocks (part Nos. 151, 152, and 153) are intended for use in place of built-up pulley blocks. They are complete with lifting hook and a lug to which the hoisting cord may be attached, and they form very realistic accessories.

A single Cone Pulley corresponds to three ordinary Pulleys of ¾″, 1″, and 1¼″ diameters formed into a unit. Cone Pulleys are intended for use in pairs, so that a drive can be transmitted from one Cone Pulley to the other by a belt passing round, say, the ¾″ diameter groove of one and round the 1¼″ groove of the other. Then if it is desired to vary the relative speeds of the shafts, the belt may quickly be removed and placed over the 1″ groove in each Pulley, or alternatively, round the 1¼″ groove of the first Pulley and round the ¾″ of the second. The respective speed ratios so obtained are roughly 5 : 3 ; 1 : 1 ; 3 : 5.

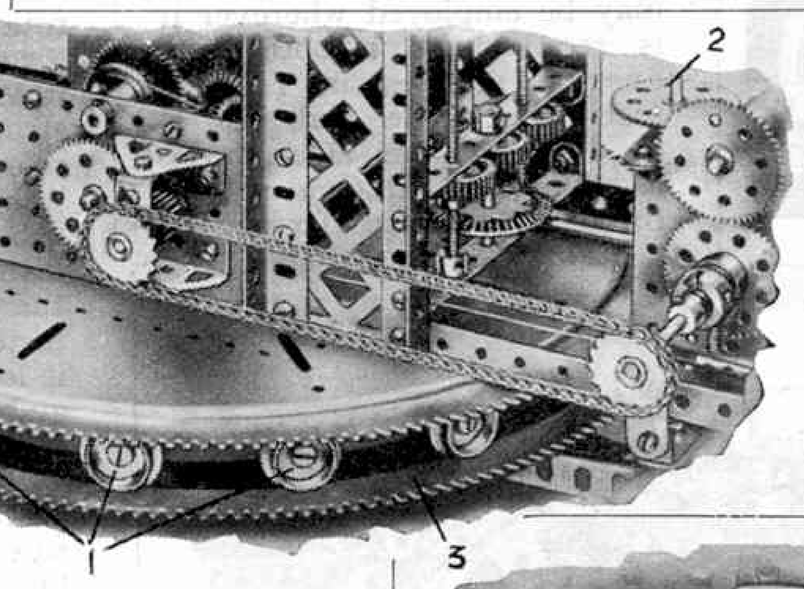


Fig. 11

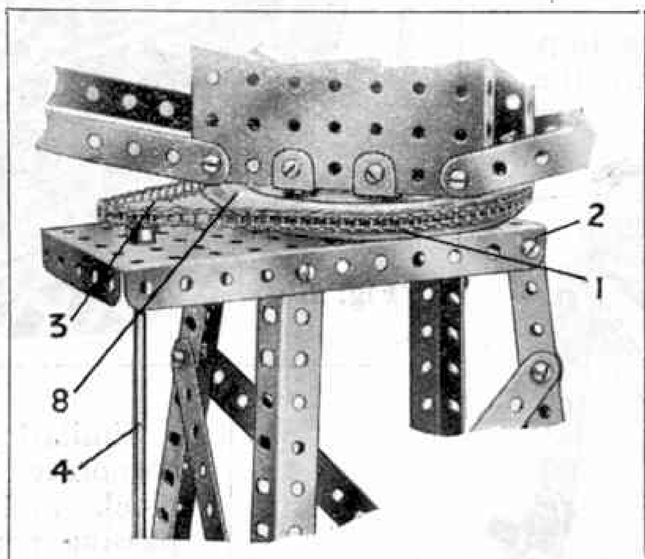
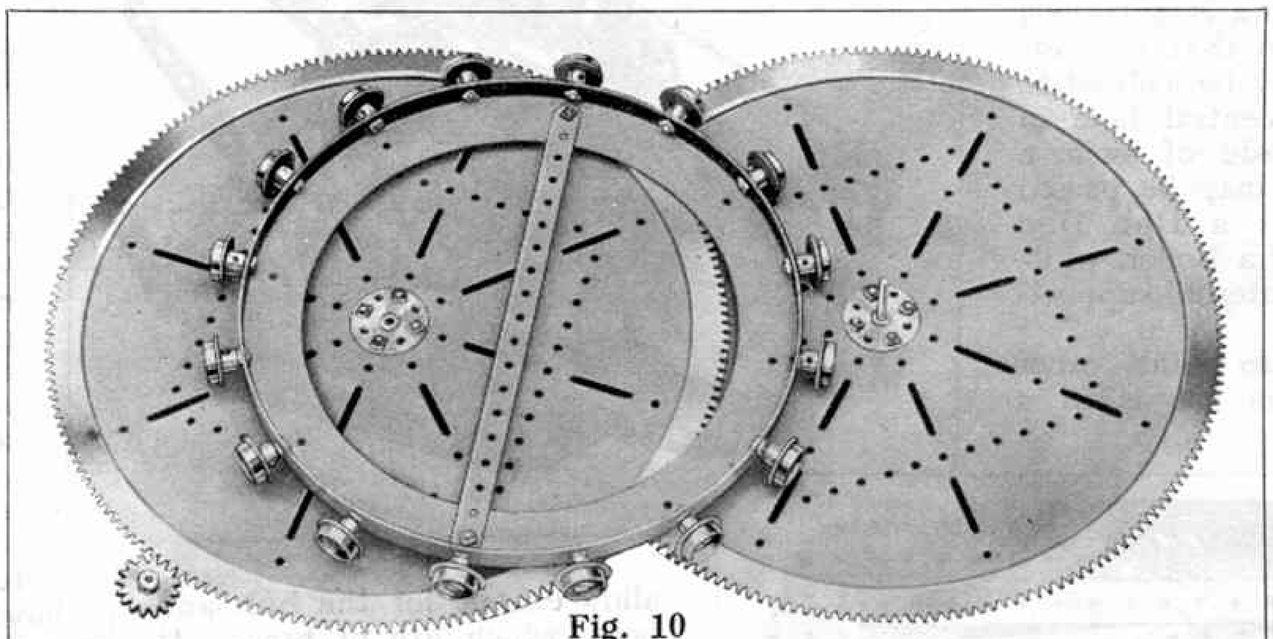


Fig. 13

Roller and Ball Bearings

The Meccano Geared Roller Bearing, illustrated in Fig. 10, consists of the following units : two Geared Roller Races, one Ring Frame, sixteen ¾″ Flanged Wheels, sixteen Pivot Bolts each with two nuts, one 9½″ Strip, two Bush Wheels, one 1½″ Rod, ten Nuts and Bolts, and one special Pinion. The complete bearing, which may be obtained under Part No. 167, measures 12″ overall diameter and is intended for use in building large swivelling structures, such as rotating cranes, bridges, turntables, roundabouts, etc.


Fig. 10

The Roller Bearing is assembled as follows : One of the Roller Races is secured to the fixed portion of the model and the 1½″ Rod is fastened in the Bush Wheel bolted to its centre. The Ring Frame is then placed over the Race so that the flanges of the wheels run upon its raised rim. The second Roller Race is then placed over the Ring Frame so that its raised rim rests upon the flanges of the wheels. The 1½″ Rod passes through the centre hole of the 9½″ Strip that is bolted across the Ring Frame, and through the Bush Wheel in the centre of the upper Roller Race.

If the driving mechanism is incorporated in the swivelling superstructure of the model, a simple way to effect the rotation of the superstructure is to mount the special 16-teeth Pinion on a vertical driven Rod so that it engages with the teeth of the lower fixed Roller Race. The vertical Rod should be journalled suitably in the superstructure ; then if it is set in motion, the Pinion travels round the Roller Race and carries the superstructure with it. Alternatively, if the driving mechanism is in the fixed base of the model, the Pinion should be secured to a Rod journalled in a vertical position in the base and caused to engage with the upper Roller Race.

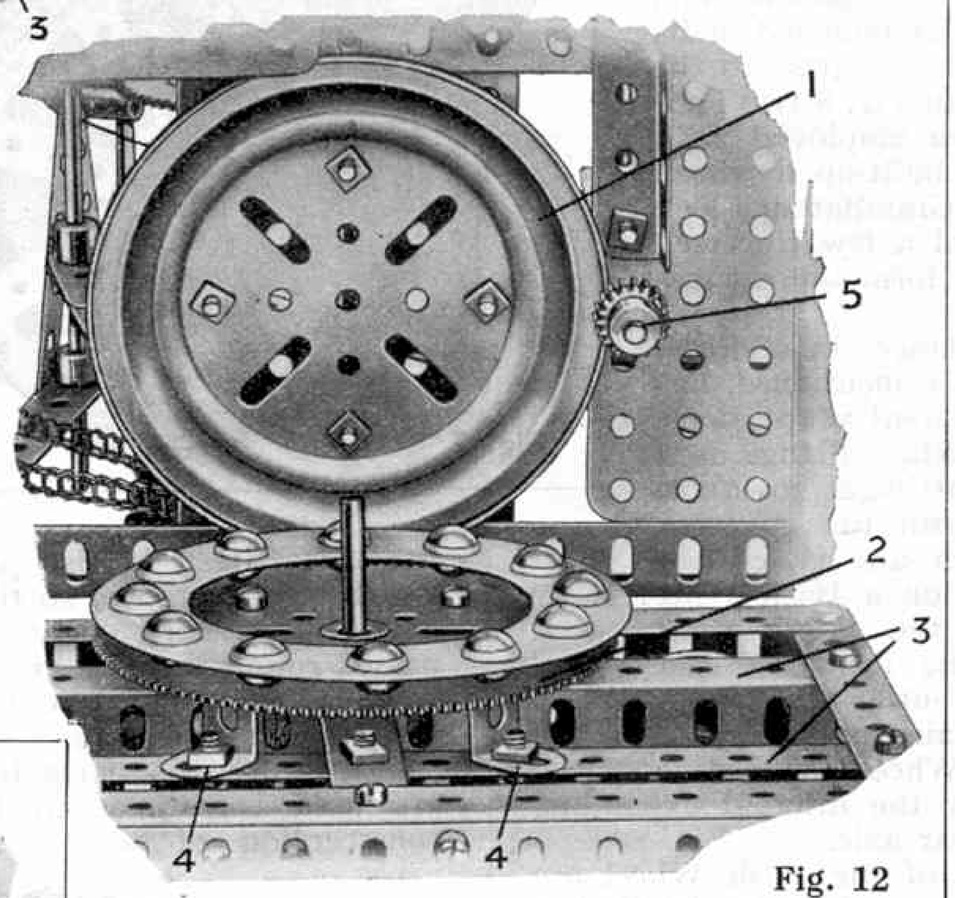
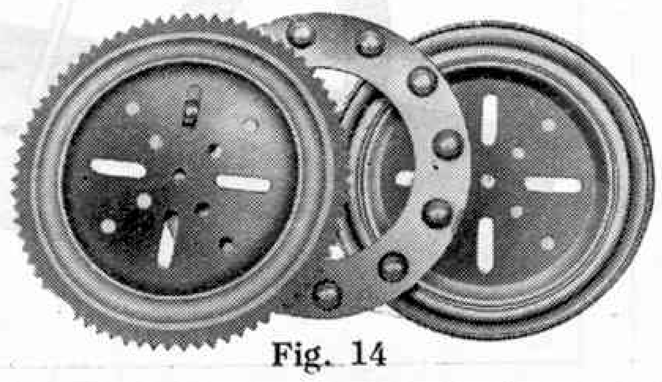


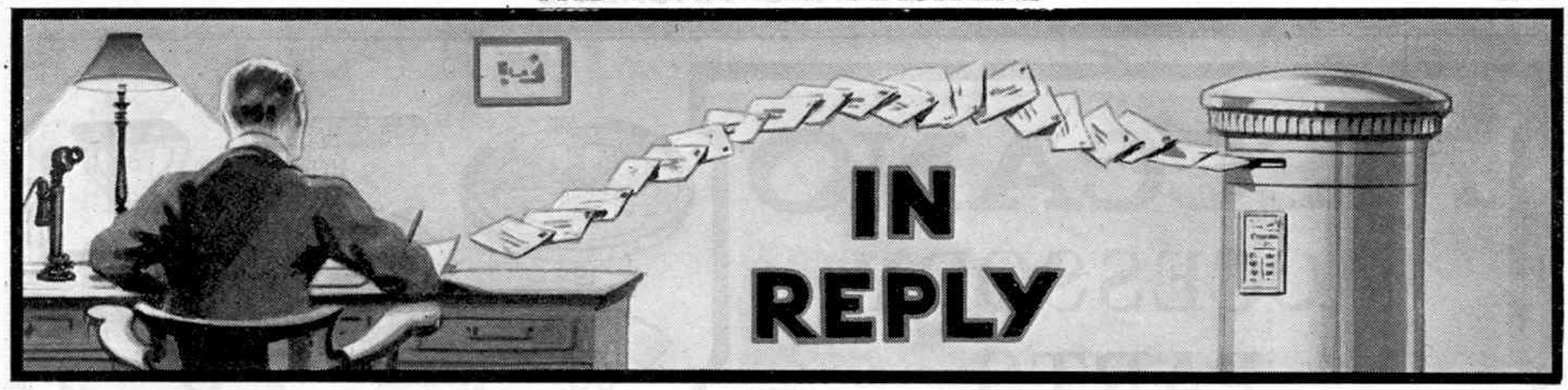
Fig. 12

Fig. 11 shows a typical adaptation of the standard Roller Bearings. In this case the superstructure is caused to turn round on the Flanged Wheels 1 on operation of a certain lever incorporated in the control mechanism. The drive from the Motor controlling the rotational movement is directed to the vertical Rod 2, on the lower end of which is mounted the special 16-teeth Pinion. The latter engages with the teeth of the lower Roller Race 3 ; hence on rotation of Rod 2 the Pinion travels round the Roller Race, carrying the superstructure with it.

If desired a large roller bearing may be built up from existing parts, without

(*Continued on page 627*)

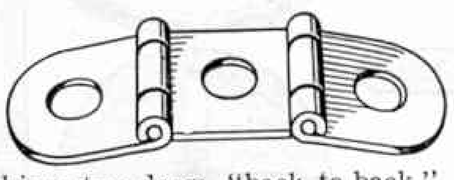

Fig. 14



READERS' SUGGESTIONS FOR MECCANO IMPROVEMENTS

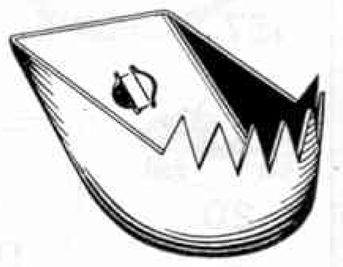
In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

NEW TYPE HINGE.—There would be little point n introducing a hinge incorporating two movable lugs similar to the illustration. The only instance where this part would be of use would be when it was required to hinge two doors "back to back." Even here the use of your suggested part would not be essential as the lugs of a pair of existing Meccano hinges could be bolted together to provide the proposed article, and would function almost equally well. (*Reply to W. Lee, Gillingham*).



SPECIAL DRY CELL.—Your idea that a special dry-cell battery should be supplied for fitting inside the Meccano Boiler is distinctly novel. When incorporated in a mobile model for instance, it could be made to drive a Meccano Electric Motor, thus forming a compact power supply. There are several disadvantages, however. For the battery to fit inside the Boiler, the separate cells forming it would have to be very small. They would consequently be very soon polarised by the relatively heavy current required by the Motor. It might, of course, be possible to introduce a small accumulator into the Boiler, but even this would not prove as efficient as a full size secondary cell. (*Reply to Jim Bunsey, Seldovia, Alaska, U.S.A.*).

IMPROVED DREDGER BUCKET.—We were interested in your suggestion, that a number of teeth should be added round the rim of the Dredger Bucket (Part No. 123). The accompanying sketch shows that the Bucket would then bear a striking resemblance to the Meccano Digger Bucket! The addition of these teeth would certainly improve the "digging" qualities of the bucket when used to remove earth or similar substance, but with other materials the teeth would be liable to catch and retard the work of the machine. The alteration would moreover necessitate a slight increase of cost, which we do not consider would be justified at the moment. We will not, however, lose sight of your idea. (*Reply to D. Redman, Calgary, Alberta, Canada*).

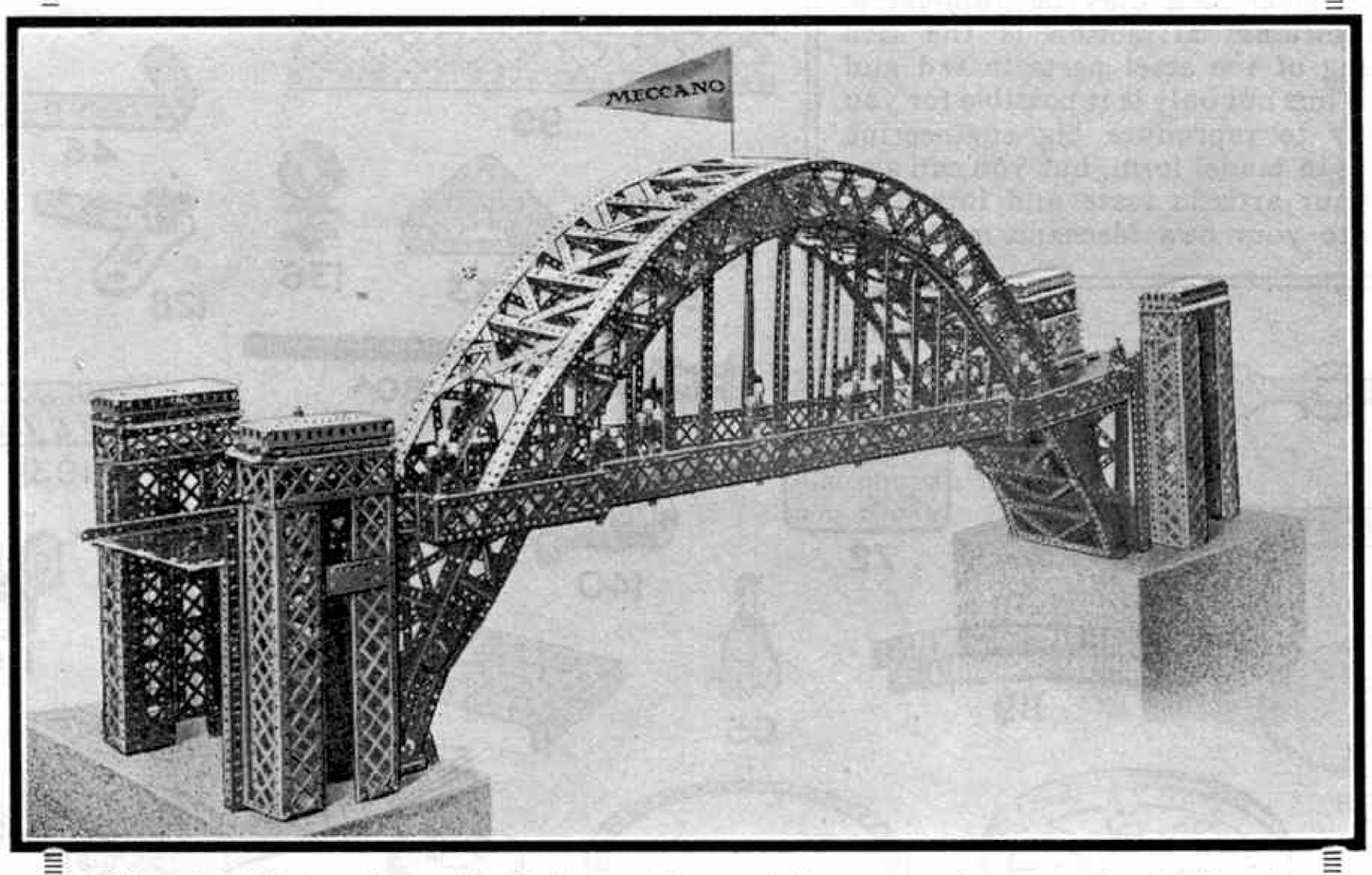


NEW BOILER END.—Your suggested design for a new type of boiler end (Part No. 162a) would hardly constitute an improvement. The suggested part would resemble a truncated cone, the bottom edge of the cone being perforated so that it might fit over the existing Boiler while the top of the cone would be of such a diameter that a Sleeve Piece might be slipped over it. The present Boiler End is however, far neater and more realistic than your suggested design. (*Reply to D. Redman, Calgary, Alberta, Canada*).

CROSSHEAD.—Your suggested new part appears to possess possibilities. It would resemble a Collar of extra length tapped and drilled in the usual way and fitted at each end with the guide portions to be found on a standard Meccano Eye Piece. No doubt a number of uses could be found for this accessory if introduced, and we will give your idea consideration. (*Reply to J. Foley, King William's Town, S. Africa*).

DOUBLE DUTY WINDING KEY.—The idea of enlarging the end of the winding key of the Clockwork Motor so that it will fit over a nut, has been put forward before, but we are making a note to give this suggestion attention at an early date. We hope to be able to make a definite announcement shortly as to whether the alteration can be carried out economically. (*Reply to N. Fainsinger, East London, S. Africa*).

Another Fine Model of the New Tyne Bridge



This model of the now famous Tyne bridge must be regarded as a masterpiece of constructional work. Built last Christmas at the Clayton Street, Newcastle, branch of the Halford Cycle Co. Ltd., under the personal direction of Mr. G. W. Horn, the District Manager, it proved so popular an attraction that it has been found necessary to retain the model on exhibition ever since! Proof of its excellence is shown by the fact that it has received high commendation from Dorman, Long & Co. Ltd., the builders of the actual bridge. Readers residing in the vicinity of Newcastle should note that the model may be inspected at 63, Clayton Street, until the end of September.

RIGHT ANGLE EYE PIECE.—An accessory somewhat resembling the existing Meccano Eye Piece, but with the guide projections bent at right angles (see sketch) would prove quite a useful addition to the Meccano system. Model-builders will know that the chief use of the existing Eye Piece is in the construction of the crossheads of model steam engines, etc., where two or more of these parts slide in guides formed from Strips. The proposed article would, of course, enable Angle Girders to be used for the crosshead guides and if it were necessary for these to be of any great length the increased rigidity that would result would be considerable. We shall certainly consider your idea. (*Reply to R. Turnbull, Hove*).



COIL SPRING.—Your idea for a special coil spring similar to that incorporated in the Meccano Clockwork Motor is quite interesting. The inner end of your suggested article would be secured to a brass collar drilled to fit on to the standard Axle Rods, while the outer end would be finished in a loop. There is an obvious objection to the introduction of this part. To wind the spring, a large torque would have to be applied to the winding spindle, and with the existing Axle Rods, slipping would occur. This would mean special square-section rods, and would complicate the system. (*Reply to J. R. Hopkins, Wallasey*).

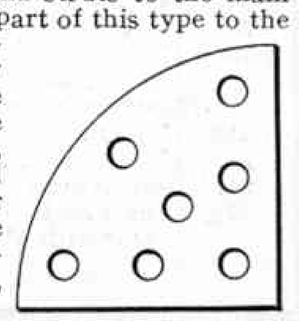
BOX SPANNER.—Your suggested design for a Box Spanner is interesting. The spanner portion would consist of steel tubing fashioned at one end to fit over a Meccano nut. The tubing would fit into a milled handle at the top of which is attached a domed rotatable head, the domed portion being held in the palm while the milled handle is turned by the fingers. We shall certainly consider the introduction of this spanner. (*Reply to R. S. Smith, Birmingham*).

IMPROVED PULLEY BLOCK.—Your criticism of the new Meccano Pulley Blocks interests us. You point out that in the case of the two and three sheave articles the pulleys tend to make the blocks "top heavy" and when used on a crane they are liable to turn over. Although difficulty might be experienced with the old style block, this should not cause trouble with the new pattern, as the cord that may now be attached to the lug will maintain the block in an upright position. (*Reply to S. C. Buzzard, London, N.3*).

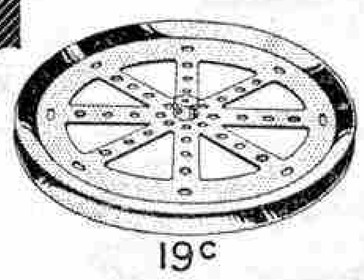
NEW DOG CLUTCH.—A dog clutch, each portion of which would be fitted with four teeth in place of two at present cut in each half of the existing dog clutch, would not be a suitable innovation, as it would suffer from precisely the same disadvantages as the design of clutch illustrated in the February issue. The cost of manufacturing such a part would be eccessive and would by no means compensate for the slight improvement in working. (*Reply to L. Redshaw, Bourne*).

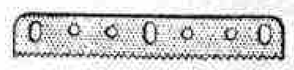
TWEEZERS.—Tweezers for gripping nuts when securing bolts in awkward places are unnecessary. We suggest instead, that you use the Box Spanner (Part No. 34b). (*Reply to J. F. Tallon, Chester*).

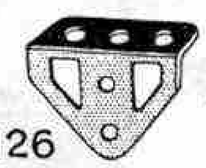
CORNER PLATE.—We were interested in your suggested form of corner plate, the design of which will be clear from the accompanying sketch. This form of plate is often employed in bridges, roof frames, etc., to rivet the joining ties and struts to the main girders. The introduction of a part of this type to the system would, however, be superfluous, as there are already several accessories that fulfil the functions of a corner plate. The Corner Bracket (Part No. 133), for example, is specially suited for this purpose, while if a larger article is required the Architrave (part No. 108) will be found useful. (*Reply to A. E. F. Spence, Manchester*).

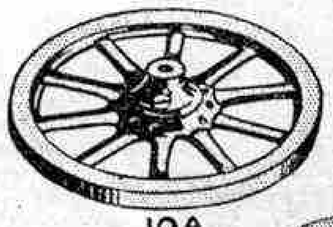


MECCANO ACCESSORY PARTS

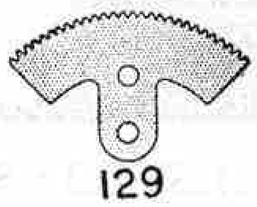

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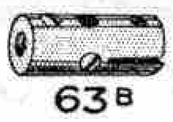

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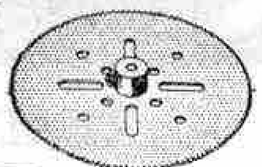

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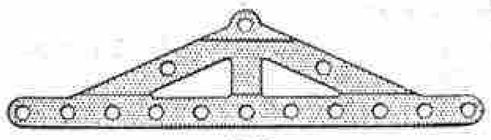

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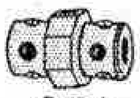

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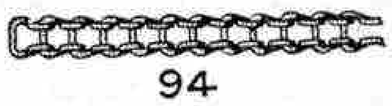

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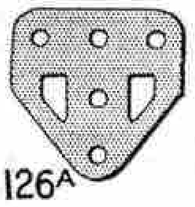
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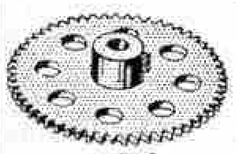

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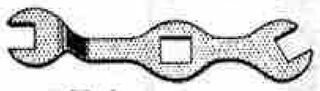

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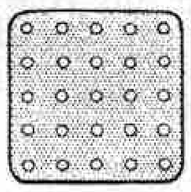

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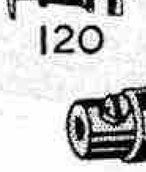

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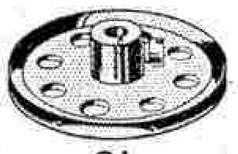

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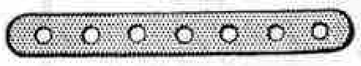

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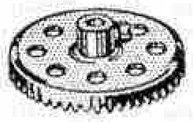

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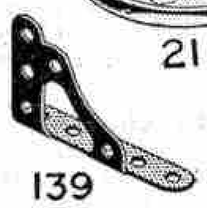

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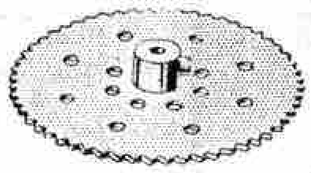

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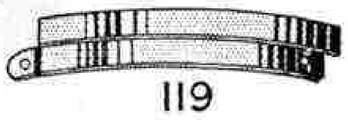

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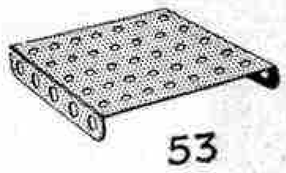

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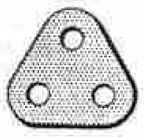

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REAL ENGINEERING PARTS IN MINIATURE

Meccano parts, a number of which are here illustrated, combine to form a complete miniature engineering system with which practically any movement known in mechanics may be duplicated.

An additional attraction is the rich enamelling of the steel parts in red and green. Thus not only is it possible for you accurately to reproduce big engineering structures in model form, but you can also satisfy your artistic taste and introduce colour into your new Meccano models.

76

123

55

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44

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125

90A

9B

99

46

20A

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133

136

128

32

132

No.		s.	d.
3.	Perforated Strips, 3½" long ... ... ½ doz.	0	4
9b.	Angle Girders, 3½" long „	0	8
17.	Axle Rods, 2" long ... 3 for	0	1
19a.	Wheels, 3" diam., with set screws ... ... each	0	6
20.	Flanged Wheels, 1⅛" diam. „	0	5
	Pulley Wheels with centre boss and set screw:		
19b.	3" diam. ... ... each	0	7
19c.	6" „ ... ... „	2	0
20a.	2" „ ... ... „	0	5
21.	1½" „ ... ... „	0	4
22.	1" „ ... ... „	0	3
23a.	½" „ ... ... „	0	3
	Pulley Wheels without centre boss and set screw:		
22a.	1" diam. ... ... each	0	2
23.	½" „ ... ... „	0	2
24.	Bush Wheels ... ... „	0	4
27a.	Gear Wheels, 57 teeth to gear with ½" pinion... „	0	6

No.		s.	d.
27b.	Gear Wheels, 133 teeth to gear with ½" pinion (3½" diam.) ... ... each	1	3
28.	Contrate Wheels, 1½" diam. „	0	9
29.	„ „ ¾" „ „	0	6
30.	Bevel Gears, ⅞", 26 teeth „	0	9
31.	Gear Wheels, 1", 38 teeth „	1	0
32.	Worm Wheels ... ... „	0	5
34.	Spanners ... ... „	0	2
44.	Cranked Bent Strips ... „	0	1
45.	Double „ „ ... „	0	1
46.	Double Angle Strips, 2½" × 1" ... ... ½ doz.	0	6
53.	Perforated Flanged Plates, 3½" × 2½" ... each	0	3
55.	Perforated Strips, slotted, 5½" long ... ... „	0	2
57b.	Hooks, Loaded ... ... „	0	3
63a.	Octagonal Couplings ... „	0	8
63b.	Strip Couplings ... ... „	0	8
65.	Centre Forks ... ... „	0	1
72.	Flat Plates, 2½" × 2½" ... „	0	2

No.		s.	d.
76.	Triangular Plates, 2½" each	0	2
77.	„ „ 1" „	0	1
80a.	Screwed Rods, 3½" ... „	0	3
90a.	2½" Curved Strips, cranked, 1⅜" radius, 4 to circle „	0	1
94.	Sprocket Chain, per 40" length	0	6
95.	Sprocket Wheels, 36 teeth, 2" diam. ... ... each	0	5
95b.	Sprocket Wheels, 56 teeth, 3" diam. ... ... each	0	6
99.	Braced Girders, 12½" long ½ doz.	2	6
103d.	Flat Girders, 3½" long „	0	7
109.	Face Plates, 2½" diam. each	0	4
110.	Rack Strips, 3½" ... „	0	2
113.	Girder Frames ... ... „	0	3
116.	Fork Pieces, Large ... „	0	3
118.	Hub Discs, 5½" diam. „	1	3
119.	Channel Segments (8 to circle, 11½" diam.) ... „	0	4
120.	Buffers ... ... „	0	2
123.	Cone Pulleys ... ... „	1	3

No.		s.	d.
125.	Reversed Angle Brackets, ½" ... ... ½ doz.	0	3
126.	Trunnions ... ... each	0	2
126a.	Flat Trunnions ... ... „	0	1
128.	Boss Bell Cranks ... „	0	3
129.	Rack Segments, 3" diam. „	0	5
130.	Eccentrics, Triple Throw „	1	0
132.	Flywheels, 2¾" diam. „	2	0
133.	Corner Brackets ... „	0	1
136.	Handrail Supports ... „	0	3
137.	Wheel Flanges ... ... „	0	3
139.	Flanged Brackets (right) „	0	2
140.	Universal Couplings ... „	0	10
143.	Circular Girders, 5½" diam. ... ... „	1	0
144.	Dog Clutches ... ... „	0	6
145.	Circular Strips, 7" diam. over all ... ... „	0	9
146.	Circular Plates, 6" diam. „	1	0
147.	Pawls, with pivot bolt and nuts ... ... „	0	3
148.	Ratchet Wheels ... „	0	6

Special Summer Contest

OUTDOOR MECCANO MODEL-BUILDING

EVERY MECCANO ENTHUSIAST SHOULD ENTER THIS NOVEL CONTEST

IN Great Britain and many other parts of the world summer is—alas!—all too short, and during the holiday month of August few Meccano boys can spare much time in thinking out how to construct a particular kind of Meccano model or how to use a specified number of Meccano parts to the best possible advantage. It is only natural that they should feel urged to lay aside the more serious problems of model-building and to make the most of the glorious summer days by spending as much time as possible out in the open air. Indeed, as the usual type of model-building competitions demand a great deal of indoor work, many Meccano enthusiasts are at this time tempted strongly to fling aside screwdrivers and spanners and forsake the hobby temporarily for more seasonable pursuits.

There are, however, equally large numbers of ardent Meccano boys who do not desire, even for a week or two, to discard their activities entirely. A special Summer Contest has therefore been arranged for this month, with the object of providing a competition in which all Meccano enthusiasts can participate and yet at the same time be free to be out in the open and benefit to the full from their summer holidays.

In this novel competition a number of splendid prizes will be awarded to the senders of photographs showing Meccano models *in the most realistic surroundings*.

As an example of what is required we would refer readers to the photograph on page 565 of the July "*M.M.*" This illustration depicts a fine Meccano model of an Excavator actually at work excavating real soil from a real embankment and loading the removed material into the open trucks of a Hornby Train.

A further instance appears on page 22 of the 1929 Book of New Models. In this case a pleasing model of the famous Panderno Bridge in Italy is shown erected in position over a miniature river of real water! On the banks of the river large stones have been placed and these when considered on the general scale of the photograph, give a wonderful and realistic impression of huge boulders and make one believe that the stream and the bridge are much larger than they really are. Indeed, so lifelike is the effect produced that one must study the photograph very closely before it is possible to say that it is all a fake.

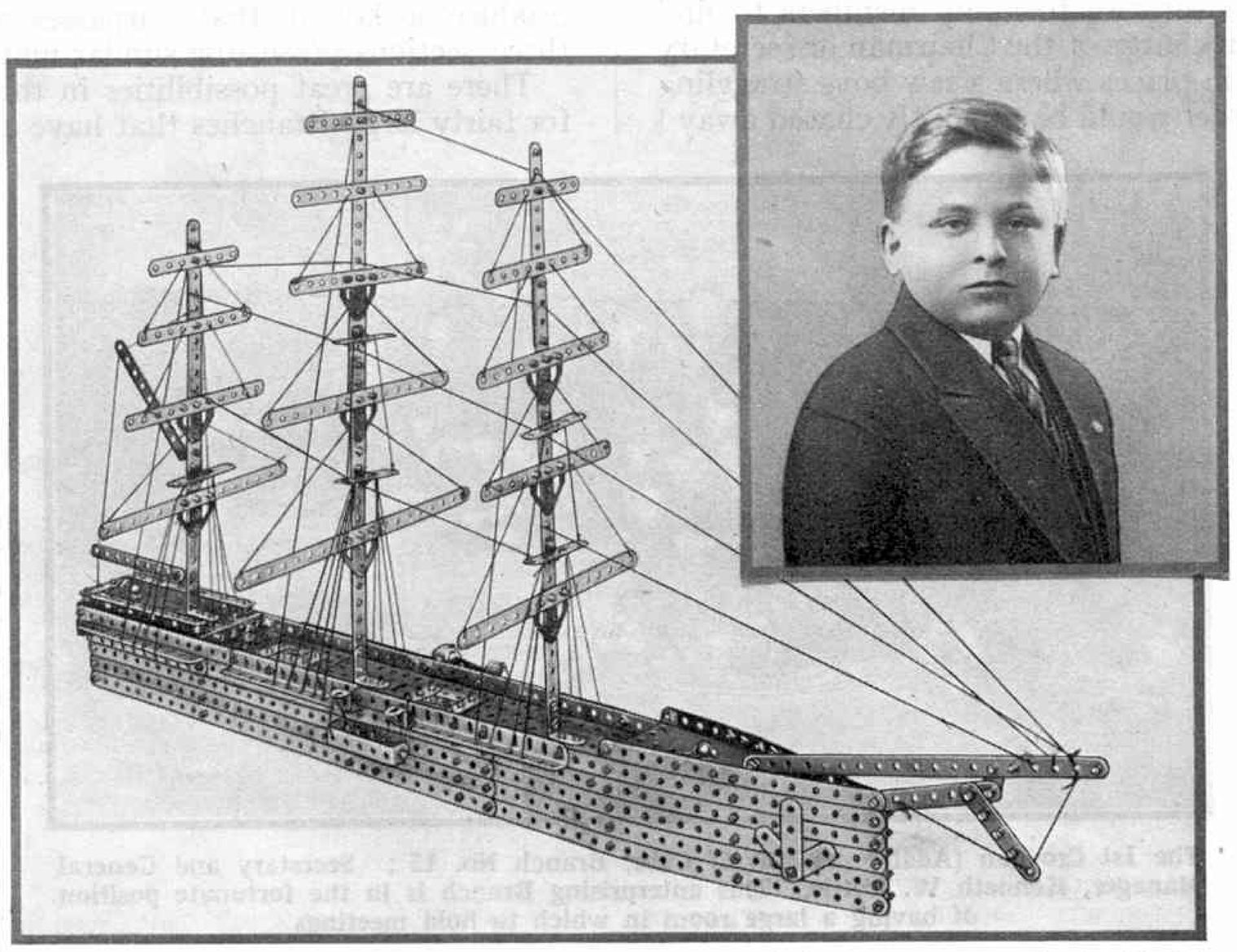
These two examples are sufficient to indicate the general lines on which competitors in this month's contest should base their ideas, but there are hundreds of other equally good suggestions that will no doubt readily present themselves to keen Meccano boys.

It is only necessary to take a "snapshot" of the model and the scenic features in its immediate vicinity and send it to "Summer Contest," Meccano Ltd., Old Swan, Liverpool.

The entries will be divided into two Sections:—Section "A" for readers residing in the British Isles, and Section "B" for Overseas readers. Prizes will be awarded in each Section as follows:—First; Meccano goods to value £1 1s. Second; Meccano goods to value 15s. Third; Meccano goods to value 10s. 6d. Also a number of consolation prizes.

Closing dates, for Section "A," September 30th, 1929; Section "B," November 30th, 1929.

A Realistic Model Exhibited in New York



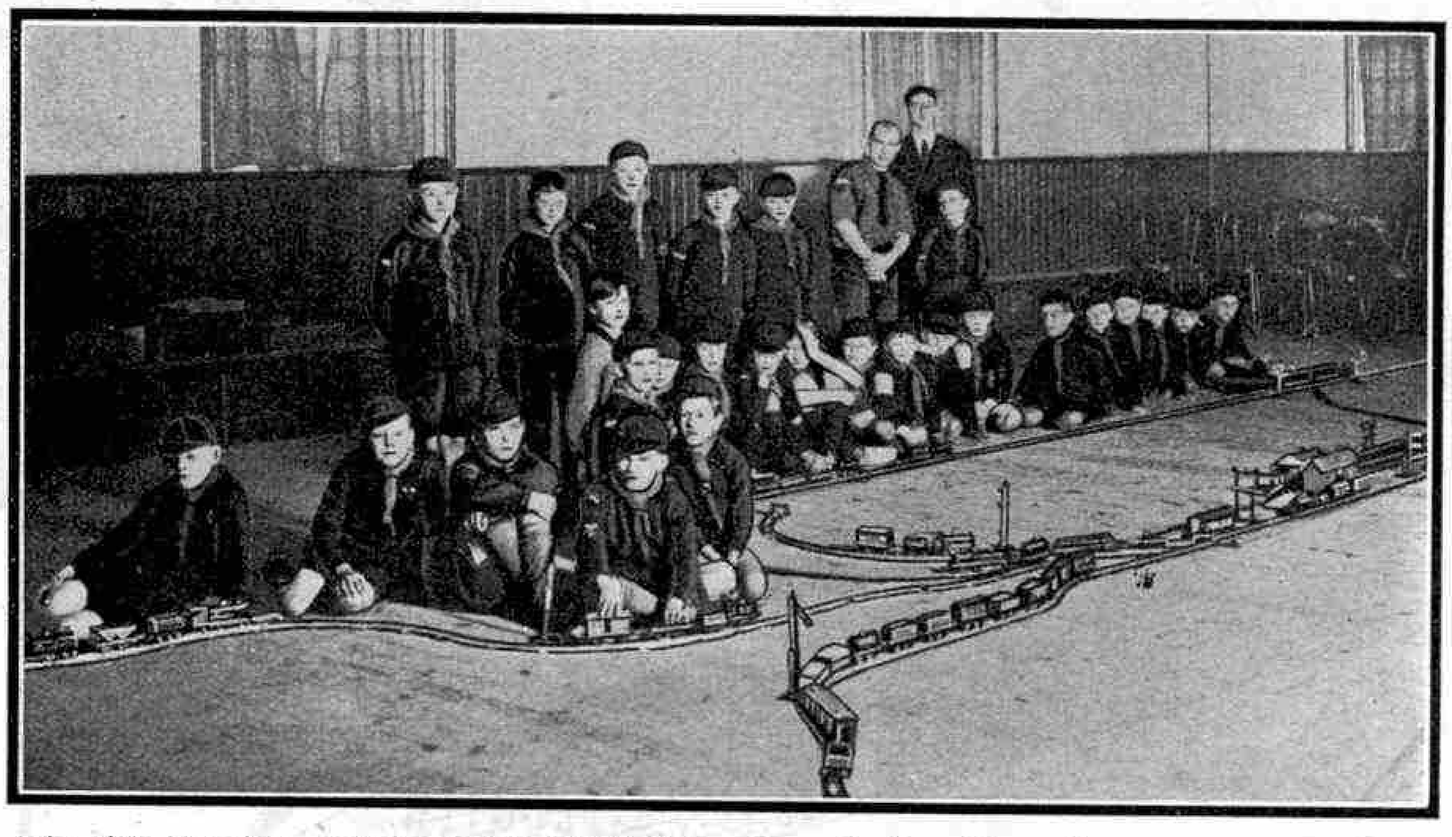
In the days when sailing ships rode the waves, one of the finest was undoubtedly the "*Sovereign of the Seas.*" So well did Harold Lessersohn (portrait, inset) catch the spirit of her in his Meccano model, reproduced above, that he was awarded a prize in a competition organised by the famous John Wanamaker Store in New York City, and his model was placed on exhibition



Organised Rambles

The suggestion I made in the June issue in regard to "prowling around" has met with a very widespread response. Many Branches have abandoned regular indoor meetings for the time being, and instead are spending their evenings in investigating the railway possibilities of their locality.

It has come as a surprise to many members to find that a small party in charge of the Chairman or secretary receives a welcome in places where a few boys straggling in with no sort of order would be promptly chased away! The fact is that the great majority of railway officials of all grades are more than willing to talk to boys who are really interested, and to answer questions and solve the various railway mysteries with which they are personally concerned. The essential thing is to make it quite clear that there is a genuine interest in railway matters, and that it is not casual curiosity that has brought about the visit and prompted the questions.



The 1st Croydon (Addiscombe) Wolf Cubs, Branch No. 15; Secretary and General Manager, Kenneth W. Nottle. This enterprising Branch is in the fortunate position of having a large room in which to hold meetings

From various reports I have received it is evident that railwaymen are beginning to take the H.R.C. Branches seriously, and to realise that the railwaymen of the future will be largely recruited from their ranks. It is beyond dispute that many H.R.C. members are now acquiring sound knowledge that will be of the greatest value to them later if they take up a railway career, as many of them are certain to do.

One Branch Chairman has adopted the interesting plan of offering a small prize of some railway material to the member who hands in the best report of an informal visit of the kind to which I have just referred. He tells me that there is keen rivalry among his members in regard to these reports, each one trying to remember details that were overlooked by the others. This is an excellent plan, and I recommend it to other Branches for it encourages members to use their powers of observation when making a tour of inspection.

A Branch Section Scheme

Among the many interesting Branch schemes of operation that have been reported recently is one in which the Branch has divided itself into four sections representing respectively the L.M.S.R., L.N.E.R., G.W.R., and S.R. Each section has its own locomotives, rolling stock and permanent way, and does its utmost to produce a layout that surpasses those of the other three sections possessing similar material.

There are great possibilities in this scheme, especially for fairly large Branches that have a good assortment of railway material. The idea might be made still more interesting if the members of each section were to devote their attention for a certain period to studying the characteristics of the railway group that they have chosen. Although the four great railways operate to a large extent on identical lines, each one has certain individual methods of doing things. I feel sure that quite a large amount of interesting railway knowledge could be gained through a section scheme of this kind and suggest this be given a trial.

Trying Experiments

I have been interested to notice during the last few months an increasing tendency among Branches to try experiments based on the suggestions put forward in the H.R.C. pages of the "*M.M.*" Several Branches, for instance, have experimented with miniature gradients on the lines suggested in the "Junior Section" article in last month's issue. The result generally seems to have been quite a surprise. There seemed to be an impression that clockwork locomotives were not capable of hauling a load up even a very slight gradient, and these tests have shown owners of Hornby engines that they had seriously underestimated the capabilities of their models. When these models have been undergoing their trials, the draw bar pull they possess has been a scource of astonishment to all onlookers.

Branch Notes

SPRINGBOIG (SHETTLESTON, GLASGOW).—During the month five well attended meetings have been held, and on each occasion members brought along railway material of various kinds to assist in producing a really big general layout. Local railway officials were interested to see the Branch's certificate of incorporation. During the next few weeks regular meetings are to be replaced by visits to various places of interest.

WINDSOR COUNTY SCHOOL.—This Branch has divided itself into four sections each representing one of the railway groups, L.M.S., L.N.E., G.W. and Southern. Each section possesses its own motive power, rolling stock and permanent way, and a prize is to be awarded to the one that produces the most effective and railwaylike layout.

ST. JOHNS (EXETER).—Has held a competition in which each member was called upon to design a layout. Meetings usually conclude with an informal discussion on various railway topics, and this is a very popular feature.

ST. AUBYNS (BUCKHURST HILL).—This progressive Branch is now producing its own magazine, which has been named "*The Engineer and Naturalist.*" Each member contributes some original item towards the contents, and the result is an exceedingly bright and interesting paper.

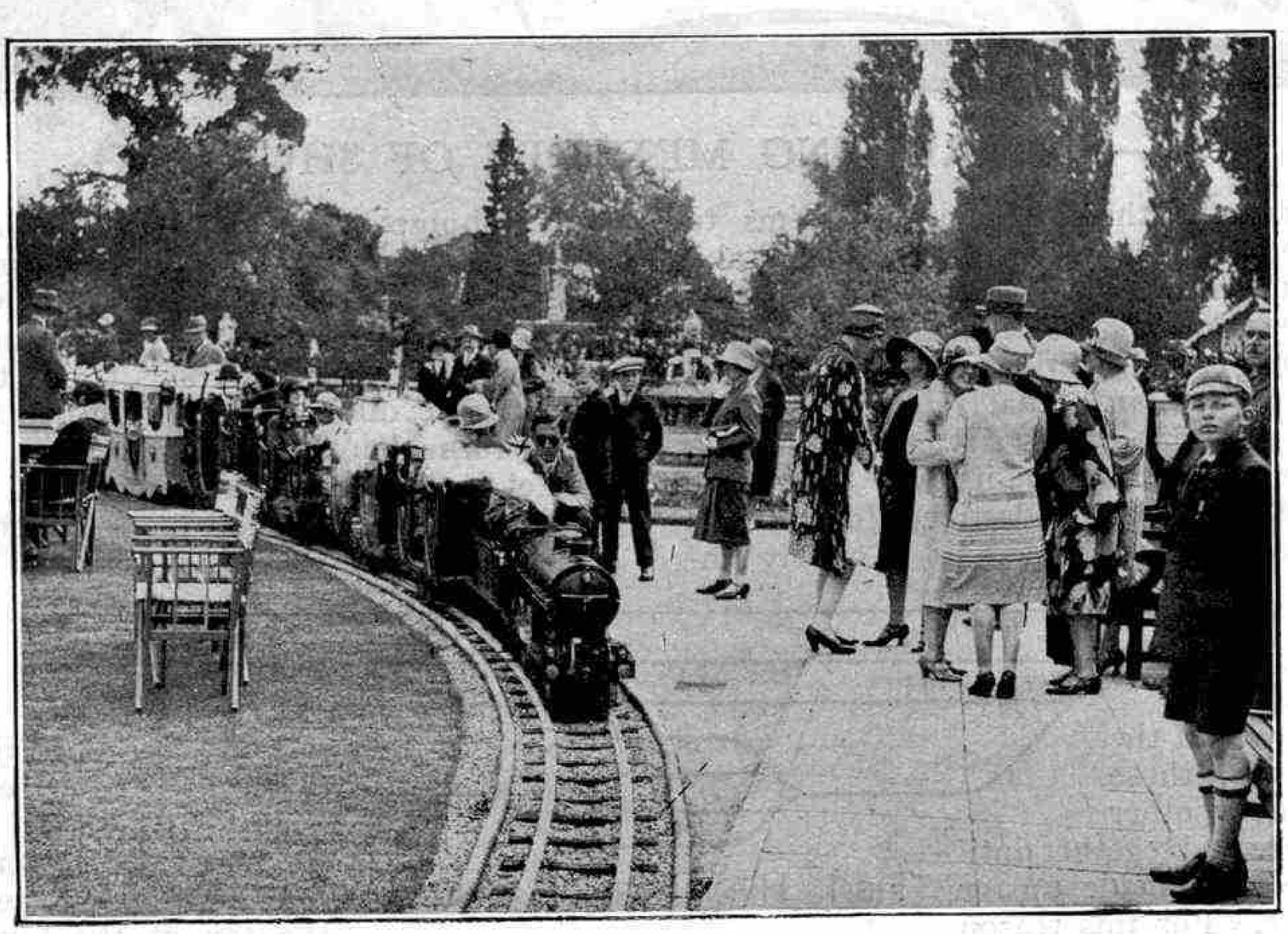
1ST CROYDON (ADDISCOMBE) WOLF CUBS.—On a recent "track night" four members gave an interesting demonstration with a "Pacific" type locomotive driven by compressed air. A popular event was a visit to the Nine Elms engine sheds of the Southern Railway. Members were conducted on their tour by an engine driver, who explained in the most interesting manner the functions of the various mechanisms that were inspected. Great interest was taken in the large turntable designed to take locomotives of the "King Arthur" class. The most memorable event was footplate rides; these left each member with the impression that he was now able to drive a locomotive!

HENDON.—At a recent meeting a very extensive layout incorporating several locomotives and a good variety of rolling stock was operated in conjunction with the Hornby Control System. The Branch took charge of a stall at a carnival held in aid of the local hospital, and as a result received useful publicity. The various events at the recent sports were keenly contested, the championship shield being won by Mr. B. Ash. In the evening parents were invited to a meeting, when the prizes were very kindly distributed by Mr. Ramsey, A.M.I.E.E.

WIGTOWN.—Meetings are held every Saturday, and a feature of these is track laying contests. Timetable working is also carried out, and arouses great interest. A weekly levy of 1d. per head is paid by all members into a fund for the purchase of new railway accessories and railway books.

SOLIHULL.—Timetable working has been a feature, and is very popular. An interesting series of tests were carried out with gradients of various degrees of severity, and great excitement was shown at the splendid behaviour of the engines that were under trial. For the next few weeks Branch meetings will be held out-of-doors.

PIXMORE.—At recent meetings interesting lectures have been given on the "*Engadine Express*," "*Niagara Bridge*," and "*Miniature Railways.*" Arrangements for the future include a visit to Hitchin Junction on the L.N.E.R.



The interesting passenger-carrying miniature railway installed by Commander Sir Edward Nicholl at his home at Shepperton. The locomotive, a G.N. "Atlantic," which is built to a scale of 2 in. to the foot, is almost 10 ft. in length and weighs nearly a ton

Further H.R.C. Incorporated Branches

45. SOLIHULL.—Hugh Aitkens, "Cardross," Broad Oaks Road, Solihull, Warwickshire.
46. SPRINGBOIG (SHETTLESTON) GLASGOW.—David Ross, 86, Hermiston Road, Glasgow, E.2.
47. MANNINGHAM (BRADFORD).—Frank Green, 28, Farcliffe Road, Manningham, Bradford.
48. THE OLD COLLEGE (WINDERMERE).—D. W. H. Owen, The Old College, Windermere.
49. BRUNSWICK (HAYWARDS HEATH).—A. H. C. Cox, Thrings (Brunswick), Haywards Heath.
50. LINDLEY LODGE (NUNEATON).—M. Moore, Lindley Lodge, Nr. Nuneaton.
51. BURSLEM AND DISTRICT.—J. H. Auty, 50, Park Road, Burslem, Stoke-on-Trent.
52. CANTERBURY AND DISTRICT.—N. Johnson, "Kincraig," Puckle Lane, Canterbury.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BELVEDERE—D. R. Maggs, 41, Barnfield Road, Belvedere, Kent.

BEXLEY HEATH—E. Gray, 157, Church Road, Bexley Heath, Kent.

BURLEY—R. Lloyd, 8, St. Annes Drive, Burley, Leeds.

BURY—T. P. Rigby, "Bellfield," 138, Manchester Road, Bury.

CARDIFF—Basil James, 51, Pencisely Road, Cardiff.

CHELTENHAM—D. W. Loyd Davies, "Montgomery," Naunton Lane, Cheltenham.

DURHAM — James Moore, 7, South Frederick Street, South Shields, Durham.

FARNWORTH—Ronald B. Taylor, 119, Peel Street, Farnworth.

GLASGOW, S.1—James Turner, 51, Melville Street, Glasgow, S.1.

GERRARD'S CROSS—T. A. Hampson, "Romani," Austenway, Gerrard's Cross, Bucks.

HARROW—L. Ridgway, 65, Spender Road, Wealdstone, Harrow.

HOUNSLOW—J. T. Cobon, 28, Montague Road, Hounslow, Middlesex.

INNERLEITHEN—Jack Prior, "The Pirn," Innerleithen, Peeblesshire.

ISLE OF WIGHT—S. Church, 7, Lower Pelham Road, West Cowes, I.O.W.

LONDON, S.W.17—E. Simpson, 72, Fishponds Road, Upper Tooting, London, S.W.17.

LONDON, S.E.27—W. H. Bugg, 80, Wolfington Road, West Norwood, London, S.E.27.

LYTHAM—W. Towler, 8a, Park Street, Lytham, Lancs.

MALVERN LINK—A. W. Church, "Rosedene," Worcester Road, Malvern Link.

OVERSEAS

AUSTRALIA—Mr. Salisbury H. Chittenden, 576, William Street, Mt. Lawley, Perth, W. Australia.

AUSTRALIA—Wm. Jamieson, 92, Osborne Street, Williamstown, W.16, Victoria.

CANADA—Jim Ryder, 97, Ferguson Avenue, Hamilton, Ontario, Canada.

INDIA—C. Watson, 36, Mazagon Terrace, Nesbit Road, Mazagon, Bombay.

TASMANIA—Drummon McLaren, 4, Fitzroy Place, Hobart, Tasmania.



X.—INTERESTING METHODS OF SHUNTING

TRYING out various methods of shunting seems to be a very popular pastime with many Hornby enthusiasts, and in order to increase the pleasure of those who like to undertake the marshalling of their own goods trains I propose to describe two novel methods of shunting that are used in actual railway practice.

Shunting plays a very important part in the handling of goods traffic. A goods train on its way to a large railway centre picks up trucks destined for various stations in all parts of the country. It is clearly impossible for a particular engine to convey to its destination every truck picked up, and instead all the trucks are sorted out, those for each big station or other large centre being collected together until there is a complete train made up for that particular place. For this reason we find outside or near all large manufacturing centres or seaports extensive sorting sidings where the trucks from all the goods yards in that area are sent to be sorted out until complete trains are made up for other big centres served by the railway.

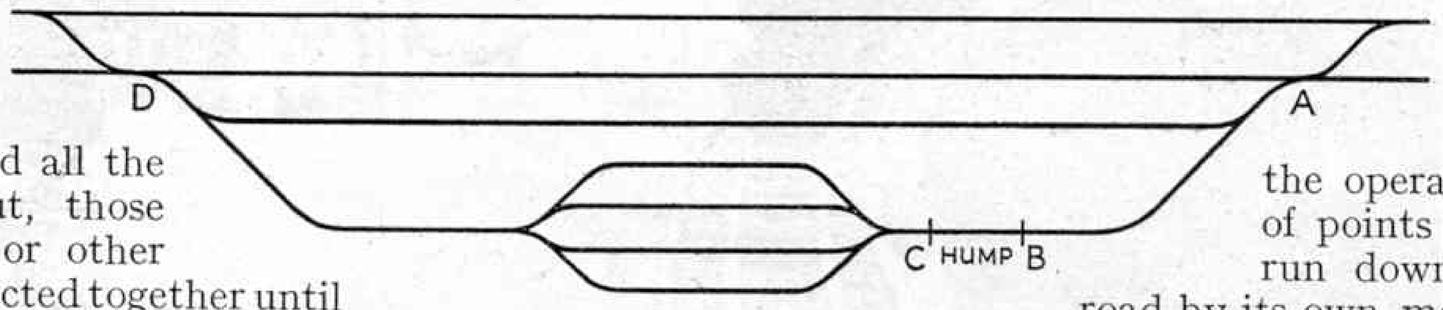


FIG. 1. HUMP SORTING SIDINGS

Suppose, for example, we take the case of a truck to be conveyed to London from one of the large goods stations in Liverpool. This truck would not be sent direct from Liverpool to its destination, but would only be taken to the sorting sidings at Edge Hill. Here it would join company with other trucks from the various goods stations in the area, to form a complete train for the London district. Similarly, the goods trains arriving with vehicles for different stations in Liverpool would be split up at Edge Hill, and all the trucks for the various yards would be made up into trains and sent to them. The sidings usually consist of a number of loop lines running into a centre line, each end of which is in communication with the main line.

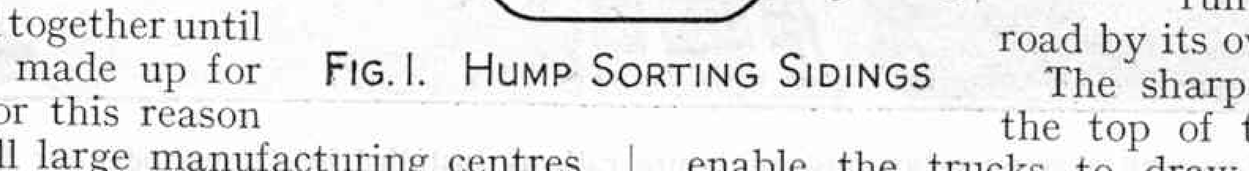


FIG. 2. SHUNTING ON SINGLE LINE

Another type of sorting sidings is the "gravitation yard," the first of which was opened at Shildon in 1865. One of the largest gravitation yards is the "Gridiron" at Edge Hill, opened in 1881. The latest development of this type is the "hump" yard, a splendid example of which is that at March, in Yorkshire, opened early this year.

Fig. 1 represents a simple type of hump yard. The goods train would have its locomotive detached, and the trucks would be pushed up the steep gradient of the hump between the points B and C. At C is the highest point of the hump, and from there is a steep descent of 1 in 18. Each loop line would accommodate the trucks for certain towns or centres, so that on the arrival of the various goods trains the trucks would be run to the different loops, until a complete train had been formed for each place.

Let us follow the movements of a local goods train arriving at A. The engine is taken off, and the train pushed along the siding AB and up the hump BC. As each wagon reaches the top of the hump C, it is uncoupled, and by the operation of different sets of points each one is made to run down into its appointed road by its own momentum.

The sharp descent of 1 in 18 from the top of the hump is necessary to enable the trucks to draw rapidly away from each other so that there is a space large enough to operate the points between each wagon. Coming down such a steep gradient, the trucks reach a speed too great for the shunters to operate the hand brakes. For this reason the trucks, after passing over the main points leading to the various roads, have their speed reduced by means of mechanically operated brake rails known as "retarders."

A Hornby hump yard is quite easily constructed, and will provide a great deal of interest and amusement. In order for it to work quite successfully it should be four or five feet in length. The commencing gradient should start from the main line at about 1 in 20, or a rise of about half-an-inch for each straight length of rail, until it reaches the peak of the hump. Then it should run level for about one rail length, and finally drop down over the hump at a falling gradient of about 1 in 15, or three-quarters of an inch for each rail length. In order to ensure safety in operation the track at its highest point should not be more than three inches above the ordinary level, and it is advisable to carry the rails on boards supported by small wooden blocks.

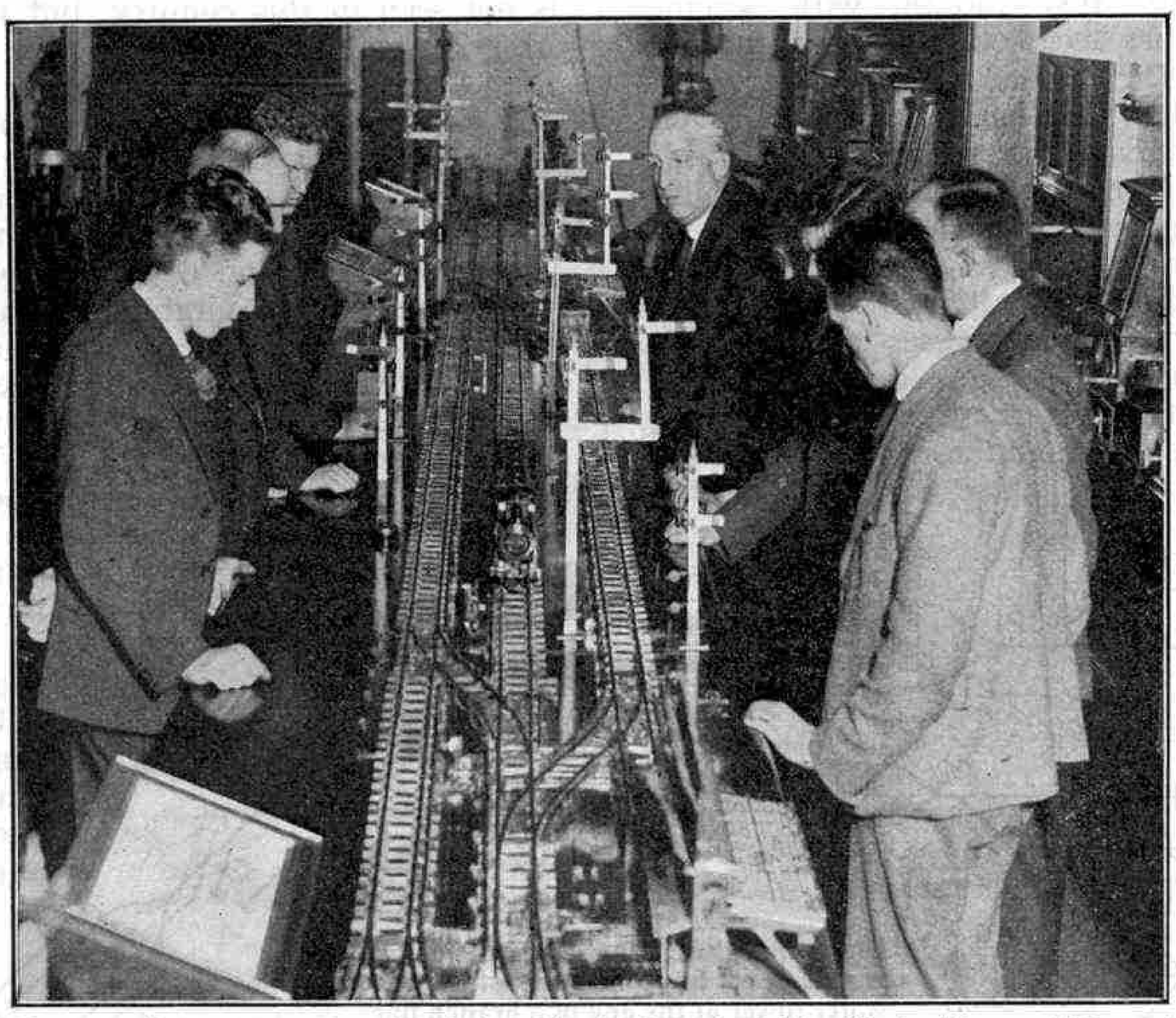
At the top of the hump there should be a number of points leading to as many sidings as are sufficient to cope with the traffic. These roads or sidings should also be mounted on boards supported by wooden blocks. The boards and blocks may be made at home or obtained cheaply from any joiner. They should be kept

permanently for this particular purpose, and can be stored away with the railway when it is dismantled. The gradients mentioned may seem rather slow, but it will be realised that 1 in 20 is quite steep enough for a couple of Hornby tank engines to push up trucks.

To use this method of shunting, all the trucks but the leading one should be coupled together and pushed up to the top of the hump. Then the locomotive stops, and the points are changed for the siding that that particular truck is to occupy, and the truck is carried down the slope into the correct siding by gravity. This fascinating operation is then repeated until the whole train has been split up among the different sidings.

To assemble the train again, the locomotive enters the bottom of the hump and draws the wagons out of the different sidings until a complete train is made up, and then proceeds on to the main line at D, Fig. 1.

It will be found that if the wagons are made heavier, better running will be made down the steep gradients into the sidings, and the wagons will also run freer and travel a greater distance by themselves along the sidings. Goods of any description may be placed in the wagons, so long as the load is not made excessive.



Young railwaymen undergoing instruction in the art of signalling. The model layout shown is capable of reproducing all the signalling movements that are employed in actual practice

A Novel Shunting Device

One of our readers recently sent us particulars of an unusual method of shunting he saw being carried out while he was on a visit to the north of Scotland. We tried out this method on our demonstration track and found it quite fascinating. Also it has the advantage that it can be adopted by the Hornby enthusiast who has not much track, or only a limited amount of space at his disposal.

Fig. 2 is a plan of a simple layout. It consists of a single main line with a dead-end siding branching off and running parallel with it. As trains are allowed to run in both directions, the goods trains that trail the points have no difficulty in reversing and depositing their trucks in the sidings. It is when the train approaches facing the siding that the difficulties arise in shunting trucks on to the siding without trapping the locomotive, and the following is the ingenious method used to enable this to be done.

Suppose that a train, composed of six trucks and a brake van, approaches the dead-end siding, the points being set for the straight road. The engine stops a few feet in front of the point blades with the train of trucks, the brake van being first uncoupled. The engine is also uncoupled from the first vehicle and a long steel cable is attached to the rear draw hook of the engine and the draw hook of the first vehicle. The engine proceeds cautiously to allow the slack in the steel cable to be gradually taken up, and when the engine is well clear of the points these are set for the entrance of the goods wagon, or wagons, to the siding, and the engine once more proceeds slowly along the line.

The result is that, while the engine is moving along the main single line, the trucks are towed along the sidings, the steel cable being stretched right across the six-foot way from the hook of the leading vehicle to that on the rear of the engine. When the trucks reach the required position the steel cable is detached, the points are set "normal," the engine is coupled on to the brake van again, and once more proceeds on its journey.

There are one or two exceptions to this procedure, but these make little difference. For instance, if one or two trucks have to be extracted from the middle of a long train, the difficulty is easily overcome by detaching the leading wagon of those required to be shunted, and fitting the steel cable from it to the previous vehicle. Readers will realise that the rest of the wagons or vans are detached from the rear of the separated vehicles.

A similar method to that just described is extensively used in large goods yards and warehouses, but in place of the engine a capstan is used, this usually being driven by electrical or hydraulic power. A good example of the use of capstans for shunting purposes may be seen at any seaport at the coal tips, where there are extensive sidings for coal trucks.

This method of shunting can be reproduced quite easily on a Hornby railway by substituting for the steel cable, used between engine and wagons, a length of Meccano spring cord or even a piece of ordinary string. It is advisable not to make the string less than nine inches in length, as a smaller piece has a tendency to pull the trucks off the rails. Loops at each end of the string should be made to attach to the draw hooks of the vehicles, or if desired, fine wire loops can be utilised. It has been found that when empty wagons are shunted on to the siding they are at times apt to jump the metals, owing to their lightness, and to overcome this difficulty we recommend that the wagons should always be loaded. The correct position for a siding of this description on a small layout would be opposite to a station, when it would serve both as a goods and carriage dock.

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

Hornby Railway Company

JUNIOR SECTION

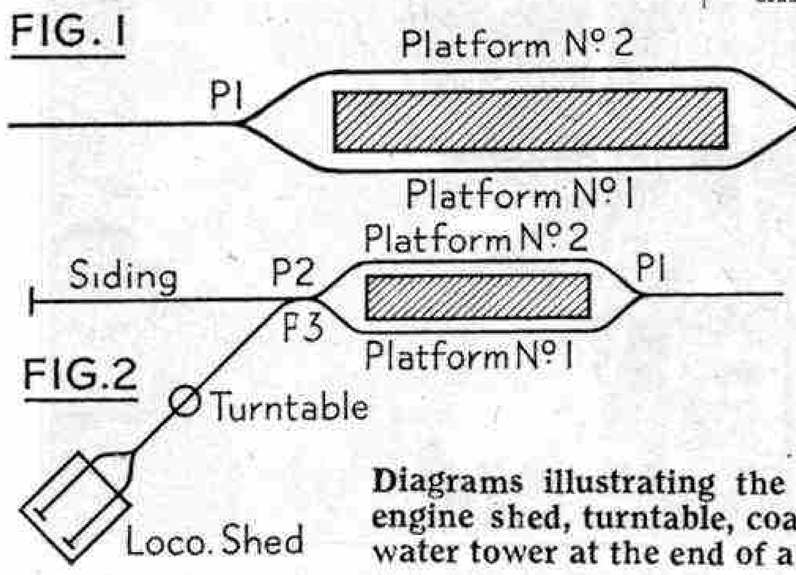
VIII.—Familiar Lineside Features—(*Continued*)

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

CONTINUING my talk on familiar lineside features, I will commence this month with engine sheds, indispensable accessories on any railway.

On real railways the engine shed plays the part of a stable, for it is there that the "iron horse," while off duty, receives his grooming and is prepared for his next journey. There is certainly no more familiar feature at all the large stations and junctions that we pass during a railway journey.

No model railway, however small it may be, can be considered complete unless it possesses at least one engine shed. Although model sheds do not play a part of the same importance as those on real railways, they are nevertheless the most suitable place for housing locomotives when these are not in use, and in preventing them from accidental damage. Quite apart from all this, however, there is the question of appearance; and there can be no doubt that an engine shed increases the realism of a layout to an enormous extent.



Diagrams illustrating the position of engine shed, turntable, coal stage and water tower at the end of a branch line

There are three different types of engine sheds. The first is the "straight road" type, which is usually situated at the end of a branch line and generally consists of one or more short parallel roads laid through the building. The Hornby No. 1 Engine Shed is a typical example of the type of shed that is in extensive use at the terminals of small branch lines. The No. 2 Hornby Engine Shed is of the same type, but is a much more elaborate model.

The "Straight Road" type of Shed

When there is a single line leading to the engine shed a turntable is often placed between it and the main line, so that a locomotive has to pass over it on its way to the shed. If there are several parallel roads in the shed these are extended outside it before merging into the single line. In some cases the alternative practice is followed of placing the turntable on a small dead-end siding off the shed line, so that it is not subjected to the strain of locomotives passing over it every time they go into the shed.

The second type of shed is known as the "turntable" type, and it contains one or more turntables that have roads of various lengths radiating from them. Each turntable is connected with a road from outside the shed and enables a locomotive to reach any road in the shed with the smallest possible amount of shunting.

The third type, known as the "round house" type, is not seen in this country, but is a familiar object in America and other parts of the world. In this type the locomotive enters a turntable situated in the centre of a circular open space that connects with a road from the main line or siding and a number of roads radiating from it into the sheds. The turntable is now rotated until it is exactly opposite to the shed road that the locomotive is intended to occupy.

In every shed suitable pits are arranged between the rails so that the men can easily undertake any repairs that may become necessary underneath the locomotive. These inspection pits are also found in carriage sheds and sidings outside busy stations, as they allow an engine or other vehicle to be thoroughly examined and repairs quickly carried out. Ample water supply is provided by means of numerous hydrants fixed at suitable places beneath the roads.

Unless special precautions were taken an engine shed would quickly become full of smoke, and in fact quite uninhabitable. The method employed is to build smoke troughs in the roof in such a manner as to ensure that, whatever position a locomotive may occupy, the smoke will not hang round inside the building, but will be carried away quickly into the open air.

Removing Scale from Boiler Surfaces

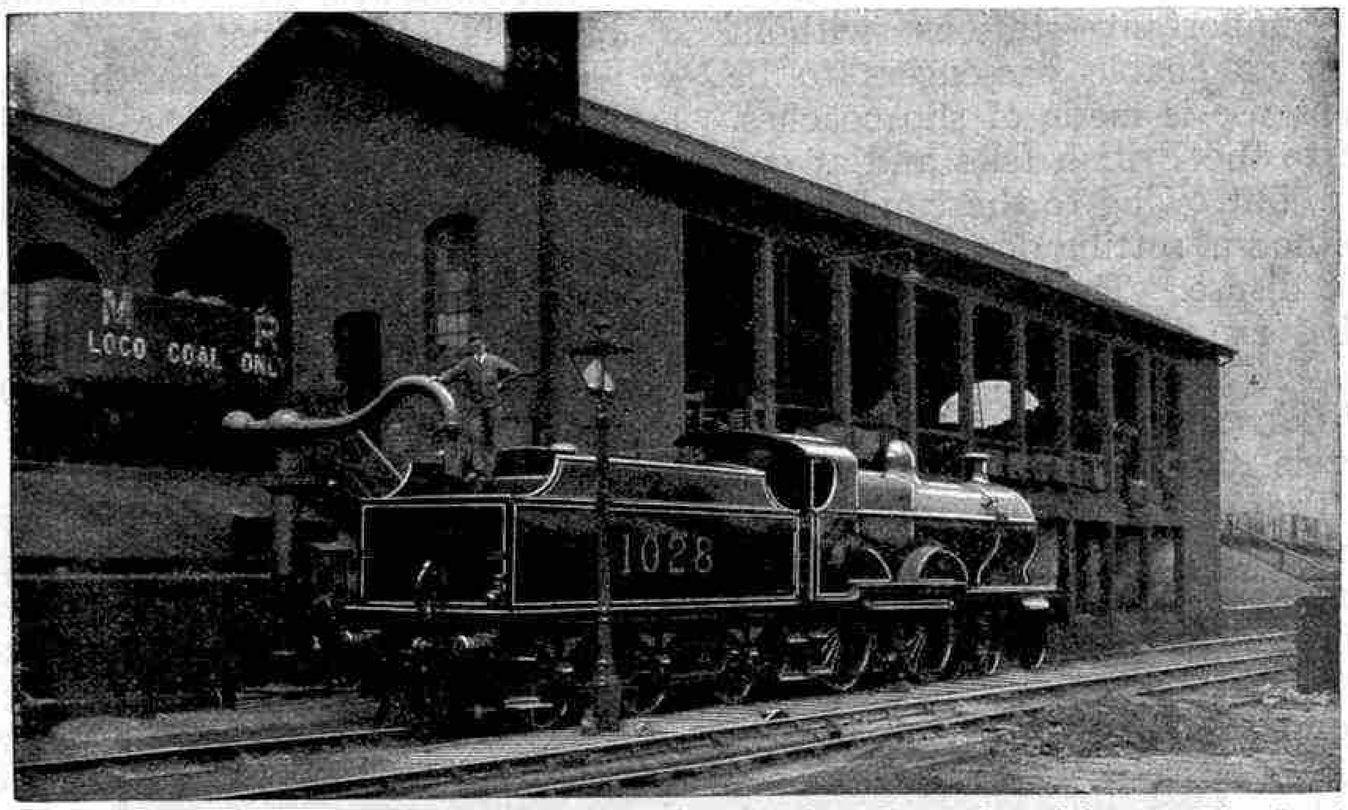
The water that is used for locomotive purposes almost always contains certain chemicals, which become deposited on the heating surfaces of the boilers. These deposits are bad conductors of heat, and therefore they must be removed periodically. This is done by means of a wire brush aided by treatment with a jet of hot water at a temperature of somewhere about 120°F., and forced through at very high pressure.

Adjoining an engine shed are offices for foremen and clerks, mess rooms for enginemen and cleaners, and well-equipped stores where spare parts, oil, grease, cloths, etc., are kept. Another accessory in the shed is the furnace for drying the sand that is placed in the sandboxes on the engines, and is used to prevent the wheels from slipping when the rails are greasy. All big sheds have of course well-staffed workshops with every facility for the complete overhaul of locomotives.

Outside the shed, in an adjoining siding, or situated alongside the line leading to this building, is the coaling

stage, which provides an easy method of handling the coal from the wagons to the tenders and bunkers of the locomotives. This stage has a platform about 13 ft. above the rail level of the road running alongside. A road running parallel with the shed line rises on a sharp gradient until it reaches the platform of the stage and continues through the building to buffer stops at the other end. The coal wagons are shunted up this incline to the buffers, and when required are run down by gravity into the stage to be emptied.

Coal from the wagons is shovelled into small trolleys, from which it is tipped down chutes from the side of the stage to the tenders or bunkers of the engines standing in the road below. These chutes are balanced and arranged so that normally they assume a vertical position. When a trolley is pushed against one, however, it tilts outward over the road until the weight of the trolley forces it into a horizontal position and the coal is shot down into the tender of the engine alongside. On the top of many coal stages there is a water tank.



The Coal Stage, Kentish Town Locomotive Sheds. Reproduced from "The Steel Highway," by Cecil J. Allen (Longmans, Green & Co. Ltd.)

Coal Stage at the end of a Branch Line

Fig. 1 illustrates the position of a coal stage at the end of a branch line. In this case an extra pair of points 4 would be traversed when passing along the siding into the engine shed, or to a position alongside the coal stage. There is also a branch line leading to the turntable, for owing to the embankment of the coal stage being against the shed line, it is impossible to insert a turntable as in Fig. 2.

To bring the coal wagons into the stage, they are brought from the siding engine first, and when they have cleared the points 3, these are changed to lead into the shed road. The points 4 are also changed over, and the wagons are then shunted up the gradient into the coal stage.

Fig. 2 is a typical example of a locomotive shed and turntable layout such as would be found at the end of a branch line. A train coming to the end of its journey passes over the points 1 and comes to rest at platform No. 1. The engine now uncouples, and proceeding over points 2 and 3 draws up on the turntable and is turned round ready for the next outward journey. If it is to go in traffic at once it runs over points 3 and 2 alongside platform No. 2; then over points 1 and so on to the single line. Points 1 are now reversed, and the engine backs on to the train standing at platform No. 1. Carriages not in use should be put on the siding, or they will interfere with shunting movements in the station.

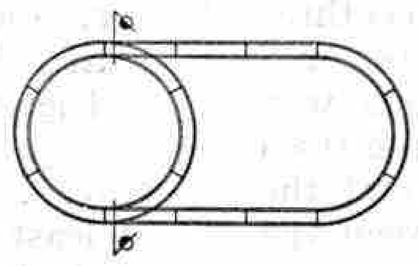
Various Types of Water Columns

Outside the locomotive shed, on and around busy stations and sidings, are to be seen the water columns where engines can conveniently replenish their water supply when on duty. There are three types of columns. The first, or crane type, consists of an arm with a heavy ball at one end, and mounted on a cast iron column in such a manner that it can be swung round from the side of the track to a position over the water tank of a locomotive. From the other end of the arm there is a long pipe made of leather, which enters the tank of the locomotive. The water is turned on by means of a wheel that is mounted on the column.

Another type consists of a large diameter upright iron pipe that has the top bent over to point downward. Attached to this pipe is a long length of leather piping that will easily reach from the column to the locomotive. The water being turned on in the same way as in the crane type.

The third type, known as the "pillar" tank, has a cast iron column with a large tank above. From the bottom is taken a length of flexible piping to reach from there to the inside of the tank of a locomotive standing on an adjoining track. A long chain extends from the top of the tank, and this is pulled down and held down by the fireman. The action of pulling the chain opens a valve, allowing the water to flow from the tank through the flexible pipe into the tank of the locomotive. The Hornby Water Tank is a very fine model of this type, and should certainly find a place on all Hornby layouts.

Suggested Layouts No. 2



1′ Radius (as illustrated): 7 Curves, 4 Straights, R.H. Points, L.H. Points.

2′ Radius: 16 Curves, 6 Straights, R.H. Points, L.H. Points.

Turntables and their Use

Turntables are to be seen at locomotive sheds, carriage sidings, and large stations where it is necessary for engines on their return journey to travel chimney first.

The most extensively used turntables are those of the "well" pattern. In these, the table has beneath it a circular well 4 ft. deep, the inside diameter being equal to the length of the turntable. The table is pivoted and has a small bogie at each end that runs on a circle of rail in the bottom of the well, so that it is easy to rotate.

The Great Western Railway use a special balanced type that is very easily laid, as no well is required. The rails for the table bogies are laid on the ground, and those on the table are the same height as the running rails. The Hornby Turntable is of this type, and it is an indispensable accessory for any terminal station layout. Its use avoids the unrailwaylike practice of picking up the locomotive and turning it round by hand!

Slip Coach Mechanism and Operation

A Great Western Railway Speciality

By 'Tommy Dodd'

ON long non-stop journeys express trains often have to pass through important stations without stopping. In order to enable passengers to be set down at these stations use is made of slip coaches. The practice is confined to the British Isles and at one time was largely followed, but owing to the trouble and expense involved this method of setting down passengers has almost fallen into disuse. The only Company that still makes extensive use of slip carriages is the Great Western Railway. As many of my readers are aware, the "*Cornish Riviera Express*" carries three slip portions. The first is slipped at Westbury, the second is detached at Taunton, and the third stops at Exeter while the main portion of the train continues its westward journey.

A slip portion contains a specially-fitted brake compartment in the leading coach. In this travels the guard who is charged with the duty of detaching it from the main train. A special slipping signal is fixed at a point where this should be done if the slip portion is to be brought to rest at the proper place.

The coupling hook at the front end of a slip coach is hinged in the middle and is kept in its normal position by a sliding bar on top, this bar being connected to what is called the "slipping lever" in the guard's compartment. The lever has three positions. These are "Main train," "Slip and brake on," and "Release." The lever operates a large three-way plug cock, the ports of which are connected to the train pipe, the brake cylinder, a vacuum reservoir and the atmosphere. A non-return valve is fitted between the plug cock and the vacuum reservoir.

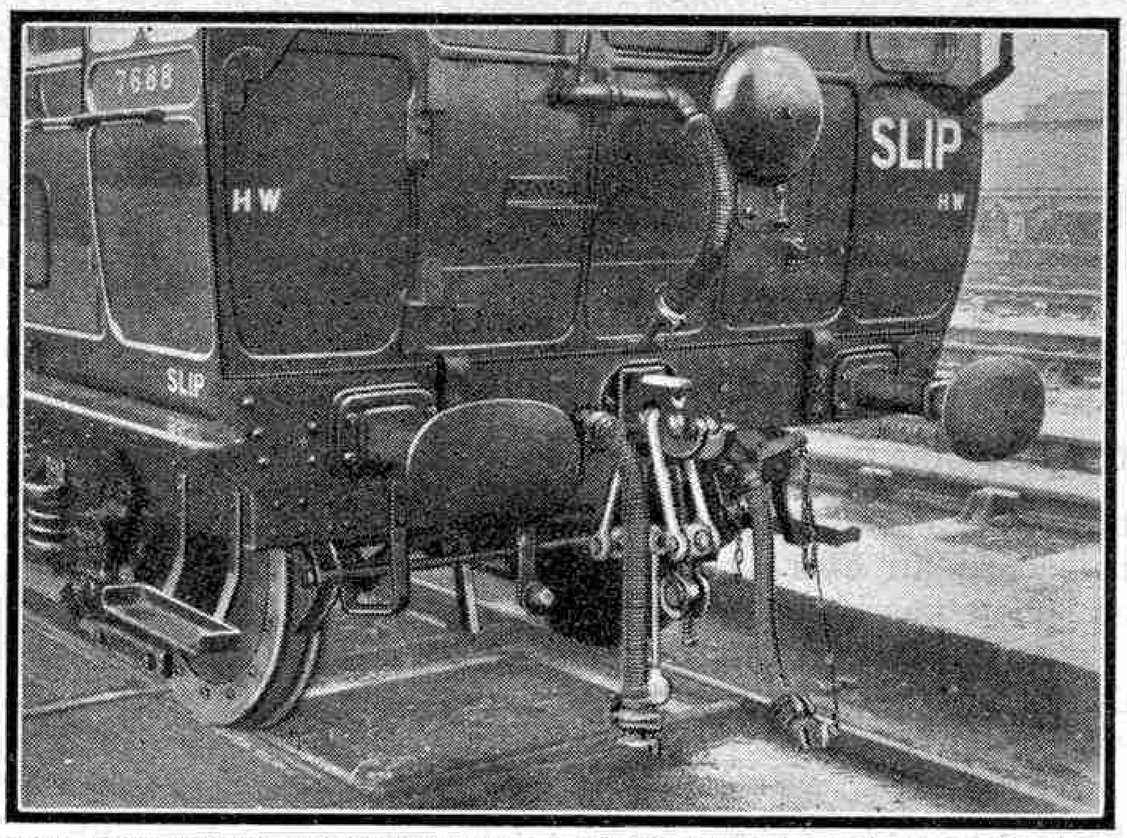
In order to allow the vacuum brake couplings to be broken the ends on the main train and slip portions are fitted with adaptors secured by pins and lugs. These fit together to make a good connection, but are capable of being pulled apart without injury. A small valve is fitted in the adaptor at the end of the main train coupling. When the gear is coupled this valve is held open by a cross member in the adaptor on the slip coach coupling and is automatically closed as the couplings are detached, thus sealing the train pipe. If this were not done air would be admitted to the brake mechanism and the train would come to a very sudden stop instead of careering ahead of the slip coach!

The screw coupling and flexible connections of the brake system are prevented by chains from falling away after the slip has been made, and the steam heating connections also are held in place by means of collapsible brackets and chains.

When the train reaches the place where the slip is to be made the guard pulls the lever back into the "Slip and brake on" position. This pulls away the sliding bar, thus releasing the slip hook and permitting it to fall. The screw coupling also falls, disconnecting the draw bars and separating the slip portion from the train. At the same time the vacuum brake and heating connections are pulled apart, the main train portion of the vacuum brake and both connections of the heating system becoming automatically sealed.

When the slip guard is satisfied that the slip has been properly accomplished he gives the driver an "All right" signal by waving a green flag or, if it is dark, by showing a green light. This the driver must acknowledge before proceeding further.

The slip portion has now been detached from the train and is running independently. The lever is in the "Slip and brake on" position, which means that air is being admitted to the brake cylinders, thus applying the brakes and reducing speed slightly. The guard now places the lever in the central or "Release" position. This closes the connection between the atmosphere and the brake cylinder, and instead places the latter in communication with a large vacuum reservoir.



End view of slip coach after the vehicles have parted, showing jaw of hook open, and flexible pipes parted. Note also the warning gong

The guard is now in a position to apply or release the brakes at will until the vacuum in the reservoir is destroyed. The capacity of this is sufficiently large to allow at least three separate applications of the brakes to be made, but great skill and care is required to ensure bringing the slip carriages to rest at the appointed place in the station, for once the vacuum has been exhausted the guard is unable to restore it. A hand brake is used to bring the carriages to a standstill.

The working of slip carriages involves the running of two trains in the same block section for a brief period, and in the interests of safety it is hedged round with the most elaborate rules and regulations. In particular, men working on the line must be protected, for they may think it safe to resume work after the passage of the main portion of the train. A bell or horn is fixed to the front of the slip portion, therefore, and is used to give the necessary warning of its approach.

To indicate to signalmen and others concerned that slip coaches are attached to the rear of a train a special code of tail lamp signals is used.

H.R.C. COMPETITION PAGE

A Locomotive Knowledge Test

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

THOUSANDS of difficult railway problems pour into H.R.C. Headquarters daily, and the members of the staff obtain little rest from the pleasant task of racking their brains in order to help members all over the world out of difficulties. We have come to the conclusion that readers think there is no railway question to which the staff cannot give an answer, and we are no longer surprised by the amazing variety of teasers that are sent to us.

Recently a really difficult problem was brought to us by the agitated secretary of a large Branch. The matter was so urgent that he had no time to send his query by post, but came personally in order to make sure that his problem could be solved immediately. Rapidly he explained his difficulty to the Secretary of the Hornby Railway Company and asked for assistance.

"Our Branch has made good progress," he said, and our funds have accumulated to such a degree that we have been able to furnish our headquarters in good style. This morning I was seated at the Chairman's desk busily preparing notes for a lecture that I am giving to-night on well-known locomotives in use on British railways. Outside the wind was howling and the rain beating down, and I congratulated myself on my good fortune on being able to work in such a peaceful and comfortable room.

"Suddenly the door was flung wide open by an incoming member, and a terrific draught swept away the pile of papers in front of me. Across the room they flew, and before I could do anything to prevent it, most of them were in the fire!

I sprang forward to snatch the valuable papers from the flames, but unfortunately I was too late. Most of them had been half-burnt, and of course those on which I had expended most time and trouble had suffered the greatest amount of damage! In readiness for my lecture I had been at great pains to compile lists of the leading dimensions of well-known British locomotives. Now all my trouble had been wasted, for all that remained of the lists was charred fragments.

The unfortunate secretary had pasted the charred remains on a sheet of paper that he had brought with him to Headquarters, but the information was decidedly mixed. The sheet is reproduced on this page, and a single glance at the first set of leading dimensions on it was sufficient to show us that there was no such engine! What the secretary was asking us to do was to sort out the details on his sheet into their correct order.

In order to soothe the frayed nerves of the harassed secretary we sent him on a tour of the Meccano and Hornby Train Factory, where he became so interested that, for the time being, he completely forgot his troubles. On his return he was delighted beyond measure when we placed in his hands an absolutely correct list of the leading dimensions of the eight locomotives to which he intended to make reference in his lecture.

After the delighted secretary had departed, it occurred to us that here was a problem that would test the knowledge and ingenuity of our readers, and we have therefore made it the basis of this month's competition. The list brought to us by the secretary is reproduced on this page. This should be copied out on a large sheet of paper and the details given must be placed in their proper order. Competitors also must give the names of the companies owning the locomotives, together with the classes and types to which they belong.

The competition will be divided into two sections—Home and Overseas. Prizes of Hornby Goods (or Meccano if preferred) to the value of £1-1s., 15/–, 10/6, and 5/– respectively will be awarded to the four competitors in each section who submit the most complete lists. In addition a number of consolation prizes will be awarded to the best of the remaining entries.

Envelopes containing entries in this competition should be marked "Locomotive Knowledge Test" in the top left-hand corner, and should be posted to reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 31st August. The closing date for the Overseas Section is 31st October.

Can you identify the eight locomotives whose leading dimensions—very much mixed up!—are given below?

Cylinders	Driving Wheels dia.	Boiler Pressure	Total Weight	Tractive Effort
18 ×26	6 ft. 8 in.	180 lb.	127¾ tons	27,070 lb.
20 ×26	6 ft. 9 in.	250 lb.	110¾ ,,	33,150 ,,
18½ ×30	6 ft. 8½ in.	225 lb.	99 ,,	27,800 ,,
15¾ ×26	6 ft. 6 in.	180 lb.	109½ ,,	18,885 ,,
15 ×26	6 ft. 9 in.	200 lb.	103¼ ,,	19,650 ,,
19½ ×26	6 ft. 8½ in.	220 lb.	115½ ,,	36,465 ,,
20 ×28	6 ft. 9 in.	180 lb.	152½ ,,	24,550 ,,
20 ×26	6 ft. 8 in.	225 lb.	112 ,,	22,000 ,,

Fourth H.R.C. Photo Contest

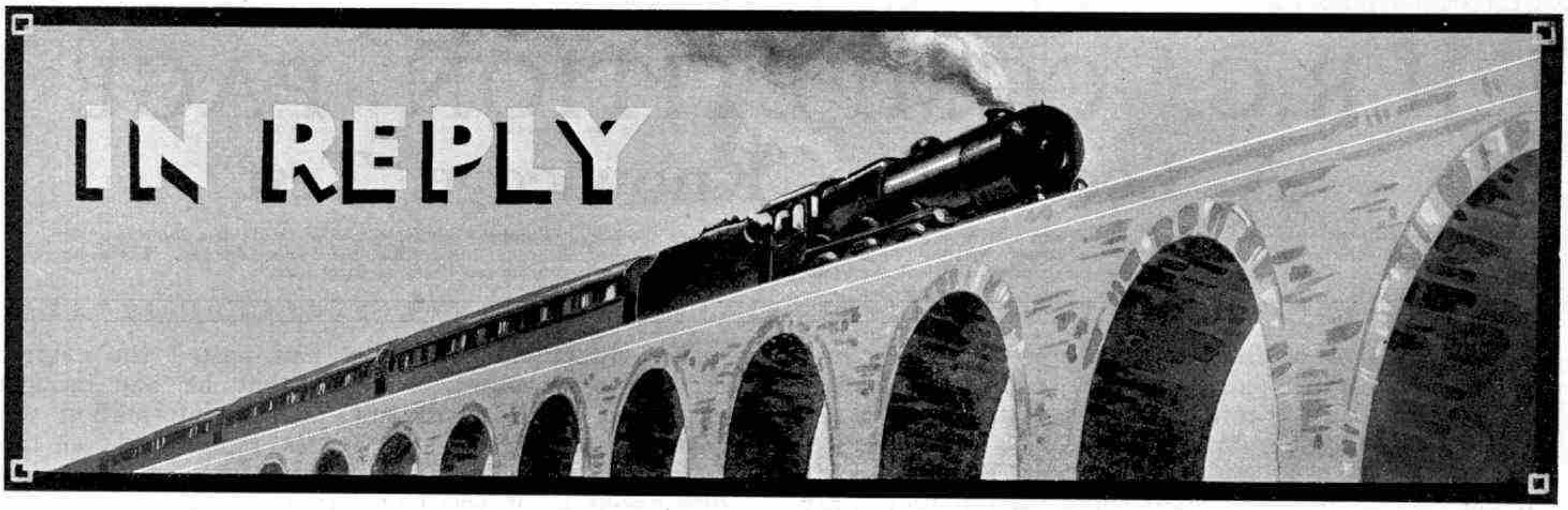
Each successive H.R.C. Photographic Contest produces better results than its predecessors, and we anticipate that the contest for this month will produce a record crop of entries.

August is recognised as "the" holiday month, and railway stations everywhere present a scene of more than usual bustle. Prizes of Hornby Railway material or Meccano to the value of 15/–, 10/6, 5/– and 2/6 respectively, will be awarded for the four most interesting photographs sent in depicting the summer-time activity at a railway station. These awards apply to each of the two sections, Home and Overseas.

Envelopes should bear the words "Fourth H.R.C. Photos" in the top left-hand corner, and competitors may submit any number of entries, but each must bear their name, address and H.R.C. number on the back. Closing date, Home, 31st August. Overseas, 31st October.

H.R.C. Competition Results—Home

April "Missing Locomotive Links" Competition. First: Ian G. Macmillan (4442), "Clunes," Kaimes Road, Corstorphine, Midlothian. Second: D. J. W. Brough (8246), Little Firs, Cheam, Surrey. Third: K. Burrow (3048), New Road, Bromsgrove, Worcs. Fourth: C. L. Jones (29), Willaston School, Nantwich, Cheshire. Consolation Prizes: Kenneth C. Crowe (8161), 59, Herbert Gardens, Harlesden, N.W.10. J. S. Ward (40), "The Hawthorns," Loughboro' Road, Belgrave, Leicester. Michael P. Murray (2240), "Craven Bank," Leigh Road, Highfield, Southampton. L. Smith (1830), 7, Milman Road, Kilburn, N.W.6. W. G. Batteson (8531), "Ravenscourt," 2, Rosslyn Road, Watford, Herts.



Suggested Hornby Train Improvements

SHORTER COUPLINGS.—Shorter couplings are now fitted to all our Hornby rolling stock, and the vehicles are brought as near to each other as is practicable, considering the radii of the curves. (*Reply to S. H. H. Browell, Hindhead, Nr. Guildford*).

MODEL TIMETABLE BOARDS.—These additions to the Hornby Series of accessories are being carefully considered, and when a definite decision is reached, an announcement will appear in the "*M.M.*"

STATION OVERBRIDGE.—This accessory can be obtained from any Hornby agent, price 3/6. (*Reply to W. H. Adams, St. Helens*).

INDICATOR FOR TRAINS.—The type of station indicator showing the time of departure and destination of the trains cannot be considered at the moment, but the idea will be kept before us. (*Reply to J. H. Auty and L. G. Morrey, Burslem, Staffs.*).

WOODEN SLEEPERS.—Your idea of fitting wooden sleepers to Hornby rails is interesting, but we are afraid that it would not prove popular, as the cost of the track would be much higher than that of the present type. (*Reply to A. G. Latty, Bristol*).

LETTERS "H.R." ON ROLLING STOCK.—Your suggestion is very interesting, but we think that Hornby enthusiasts would prefer the letters of the four existing railway companies. (*Reply to A. Toledano, Brazil, S. America*).

TANK LOCOMOTIVE NUMBERING.—Your suggestion for the numbers of the Hornby 4–4–4 Tank locomotives to be painted on the bunker side is to be adopted on all our revised models. (*Reply to R. Parry, Waterloo, Liverpool*).

DECAPOD TYPE LOCOMOTIVES.—We do not think that the introduction of a locomotive of this description would be popular. This locomotive is not very widely used on British railways, and it has such a large wheelbase that it would be unsuitable for our small radius curves. (*Reply to I. McNabb, Exeter*).

UNITED DAIRIES WAGON.—We have introduced a "United Dairies" milk tank wagon, and this can be obtained from any Hornby dealer. (*Reply to R. T. Knibbs, London, S.W.*).

RECTANGULAR TAR WAGON.—Your suggestion for the inclusion of a miniature tar wagon in the Hornby Series is interesting, and will receive consideration. (*Reply to E. F. Good, Sheffield*).

MIDLAND COMPOUND 4–4–0.—We quite agree that a model of the L.M.S. Deeley compound locomotive would be very popular, and you no doubt will be pleased to learn that we hope to introduce this model in the near future. (*Reply to H. Croome, Sutton, Surrey*).

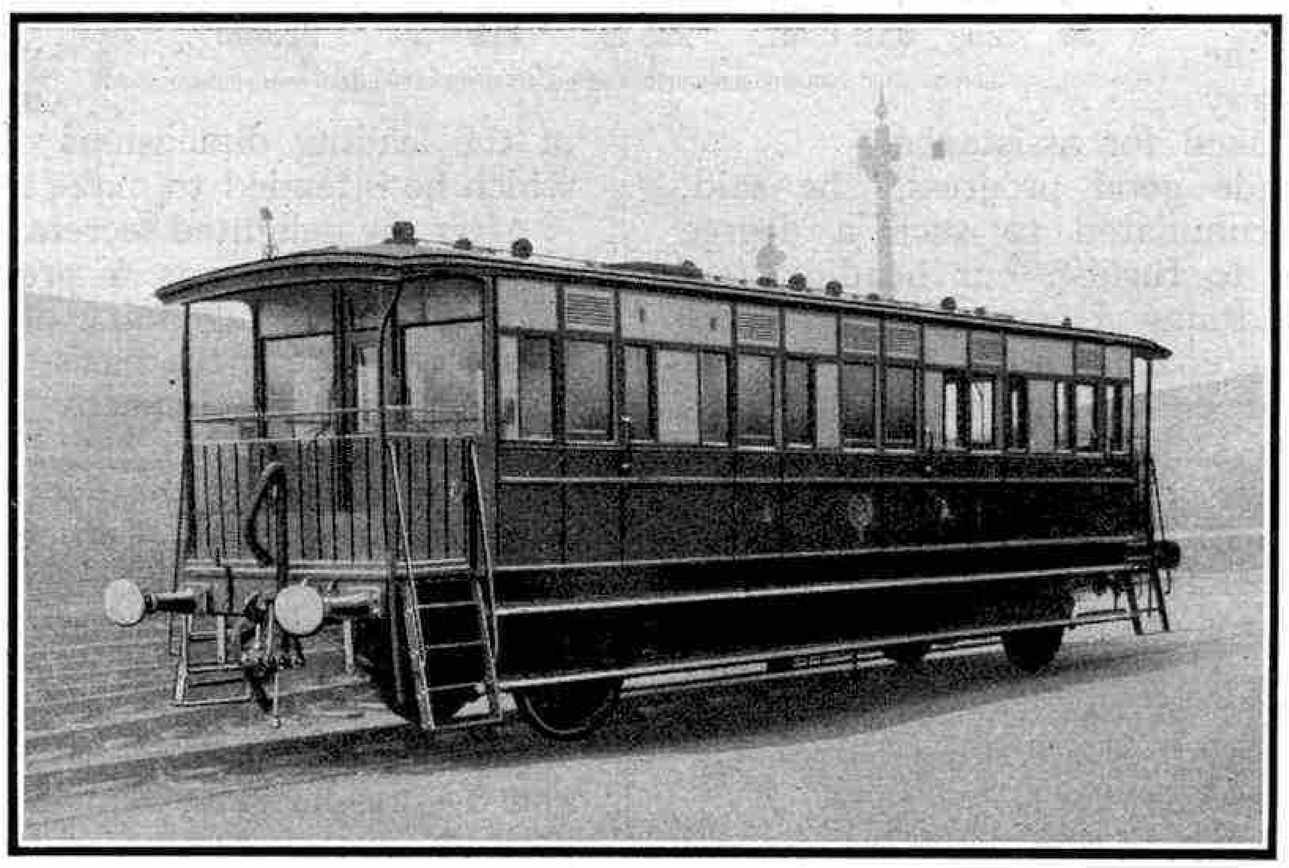
DOUBLE TRACK CROSSINGS.—The introduction of double track crossings has previously been suggested, and although we are not doing anything in the matter at present, the idea will receive further consideration. (*Reply to D. Weston, London, N.*).

CRANE VAN.—A crane van such as you suggest would certainly be a useful addition to the Hornby System, and the idea will receive careful attention when we redesign our present rolling stock. (*Reply to W. Jackson, Oswaldthwistle*).

BUFFERS AND COUPLINGS FITTED TO "M" TYPE LOCOMOTIVES.—As these locomotives do not reverse, there is no need to fit couplings. We agree that buffers would enhance their appearance, but the question of extra cost has to be considered. (*Reply to A. G. Wise, Ashford, Kent*).

DOUBLE TRACK VIADUCTS.—Your suggestion for a double-track viaduct is very interesting, and we may be able to introduce such an accessory before long. (*Reply to N. Barton, Weaste, Lancs.*).

SHEEP TRUCK.—This is not a familiar type of vehicle in England, and it is doubtful whether a Hornby model would be popular with English model railway enthusiasts. (*Reply to E. Hare, Brisbane*).



Railway Divisional Engineers are provided with special cars to enable them to make a systematic inspection of all parts of their division. Our photograph shows the inspection car of the Divisional Engineer at Neath

TANK LOCOMOTIVE OF 2–4–0 and 0–4–2 TYPE.—We cannot consider the introduction of these types of tank engines as they are old. (*Reply to V. Collins, Belfast*).

4–4–2 TANK LOCOMOTIVE.—The introduction of a 4–4–2 "Atlantic" type tank locomotive has been given careful attention, and we hope to introduce one in the near future. (*Reply to G. Jarrett, Clevedon, Somerset*).

COMBINED POINT AND SIGNAL COUPLING.—This is a good idea and will be given attention as soon as opportunity occurs. In the meantime a good substitute will be found in the Hornby Control System, which can be made to work points and signals simultaneously. (*Reply to A. Tucker, St. Petroe's, Buda*).

DETACHABLE COUPLINGS.—We do not think there would be any advantage in a detachable coupling such as you suggest. The present new short-length couplings are quite satisfactory. (*Reply to A. Lloyd, Ashford, Kent*).

"CONTROL" CROSSOVERS.—Your suggestion for crossovers to be fitted for Hornby Control is very good, and is being kept before us for further consideration. Such an improvement would then complete the number of points in the Hornby System fitted for control. (*Reply to J. Salter, Babbacombe*).

TRESTLE BRIDGE.—Although trestle bridges are familiar features in Canada, they are not seen in this country, and a bridge of this description would look rather out of place on an English model railway system. (*Reply to C. W. Parsons, Bournville, Birmingham*).

BUFFERS FITTED TO "M" PULLMAN COACHES.—Your suggestion regarding the addition of buffers to the "M" type Pullman coaches will receive consideration. We agree that they would improve the appearance of these vehicles, but of course, they would add to the price. (*Reply to B. Lingham, Bishops Waltham, Hants.*).

JUNCTION SIGNAL.—The revised type of junction signal you suggest is interesting, and we agree that it would prove a popular addition. (*Reply to S. Brown, Belmont, Surrey*).

SPRING BUFFERS ON LOCOMOTIVES.—We are afraid that your suggestion regarding spring buffers for Hornby locomotives cannot be considered, as the price of the locomotives would have to be increased. If spring buffers are urgently required, the existing buffers can be removed and separate spring buffers fitted, price 8d. per pair. (*Reply to J. C. Denley, Birmingham*).

No. 1 TROLLEY WAGON.—We do not think that this type of wagon would be very popular, but we will keep the suggestion in mind. (*Reply to J. Wilks, Barton, Lincs.*).

DOUBLE ELECTRIC TRACK.—Double electric track may be introduced later if we find that there is a demand for it. (*Reply to R. Dickson, Belfast, Ireland*).

CROSS BAR FITTED TO HORNBY WAGON.—This is certainly an interesting idea, for many wagons are fitted with this bar. Your suggestion will be filed for future consideration. (*Reply to J. Chalk, Angmering, Sussex*).

BRICK ROAD BRIDGE.—Bridges of this type can be built very easily with miniature bricks such as those supplied by Messrs. Lott's. (*Reply to C. Ray, Hull*).

SENTINEL CAMMELL COACH.—There is no doubt that a "Sentinel Cammell" steam coach would make a very interesting and attractive addition to the Hornby System, and if this type of vehicle comes into more general use we may give it consideration. (*Reply to J. Christian, Salford*).

REVISED No. 2 LOCOMOTIVE.—We are redesigning our existing No. 2 tender engines and hope to introduce these new models in the very near future. (*Reply to H. Smallwood, Whitworth, near Rochdale*).

M.3 LOCOMOTIVES FITTED WITH REVERSIBLE MECHANISM.—This is no doubt a very good idea, but the extra price that would be necessary would not prove popular. (*Reply to M. J. Skinner, Bilston, Staffs.*).

ENGINE CAB LEVERS.—We fully appreciate your suggestion for the fitting of a scale model regulator and a brake handle in place of the present levers. This no doubt would improve the general appearance and we will give it consideration, although we are inclined to doubt its practicability. Your suggestion for shortening the control rods is much more feasible and we are filing this for reference later. (*Reply to B. Wordsley, Batley*).

"EARTH" RAILS ON ELECTRIC TRACK.—The fitting of imitation "earth" rails to our existing electric track, while serving no useful purpose, would considerably increase the cost of the rails, and therefore cannot be considered. (*Reply to C. J. Brigmore, London, N.W.*).

SALT VANS.—We do not think that salt vans are sufficiently well known to be popular with the majority of Hornby enthusiasts. (*Reply to W. Chester, Northwich*).

MINIATURE BISCUIT TINS.—The introduction of miniature biscuit tins would no doubt meet with approval from model railway enthusiasts, and your idea will be given careful consideration. (*Reply to W. S. Maley, Whitstable, Kent*).

SIX-WHEELED BRAKE VANS.—Your suggestion for a six-wheeled brake van is interesting, and will be filed for reference. (*Reply to I. V. Newton, Watford*).

SPEED REGULATOR FOR LOCOMOTIVES.—A speed regulator would not be satisfactory for small locomotives, and in any case would be very costly to produce. (*Reply to G. Appleford, Ripley*).

VACUUM PIPES.—It is our intention to fit vacuum pipes on our revised locomotives. (*Reply to G. Jarrett, Clevedon, Somerset*).

SHORTER BOGIE VEHICLES.—If the eight-wheeled wagons were shortened there would be no necessity for bogies. Shortening would also curtail their carrying capacity. (*Reply to G. Keogh, Dublin, E.C.4*).

POINT RODDING CARRIED UNDER THE LINES.—The passing of signal wires and point wires under the rails for operation on the other side of the track has been under consideration for some time. As soon as a definite decision has been reached, an announcement will appear in the "*M.M.*" (*Reply to J. McGregor, Glasgow*).

IMPROVED COUPLING FOR CONTROL SIGNALS.—Your suggestion for a coupling to enable more than one signal to be operated by the same lever is very interesting, and we shall therefore keep it before us for consideration. (*Reply to J. White, Dunedin, New Zealand*).

ELECTRIC LEVEL CROSSING.—Your suggestion cannot be considered, for live rails cannot be led through a level crossing. (*Reply to J. L. H. Falls, Aberdeen*).

DOUBLE JUNCTION.—We have not received many suggestions for a double junction and we doubt whether it would be a popular addition to the Hornby Series. (*Reply to C. P. Phillips, Newton Abbot*).

PERMANENT MAGNET MOTORS.—You will be pleased to learn that we have introduced a locomotive with a motor of this type. (*Reply to P. J. West, Oxford*).

COPPER BANDS ON G.W.R. ENGINES.—This idea is being adopted on our redesigned engines, which will make their appearance in the near future. (*Reply to B. O. Shaw, Southampton*).

DETACHABLE LAMPS.—Our redesigned locomotives will have detachable lamps, and it will be possible to place head lamps on any of the four brackets, as in actual railway practice. (*Reply to J. Lee, Bury*).

ADDITIONAL ELECTRICAL POINTS.—Electrical double-symmetrical and parallel points would no doubt prove a popular addition, and will give this matter our careful attention. (*Reply to I. Weeks, Thornton Heath*).

EIGHT-WHEELED WINE WAGON.—As our present four-wheeled wine wagon meets with the approval of the majority of Hornby enthusiasts, we do not propose to introduce a similar vehicle with eight wheels. (*Reply to G. Edwards, Richmond Hill, Surrey*).

REVISED CROSSINGS.—Your suggestion for a right-angle crossing to be the length of a quarter rail is interesting. This idea has not been brought to our notice before, and as it is quite practicable, it will receive careful attention. (*Reply to F. van Went, Rugby*).

DOUBLE TRACK POINTS.—We do not contemplate the introduction of double track points at present, but we hope to give this suggestion our attention in the near future. (*Reply to A. Seiler, Oswestry*).

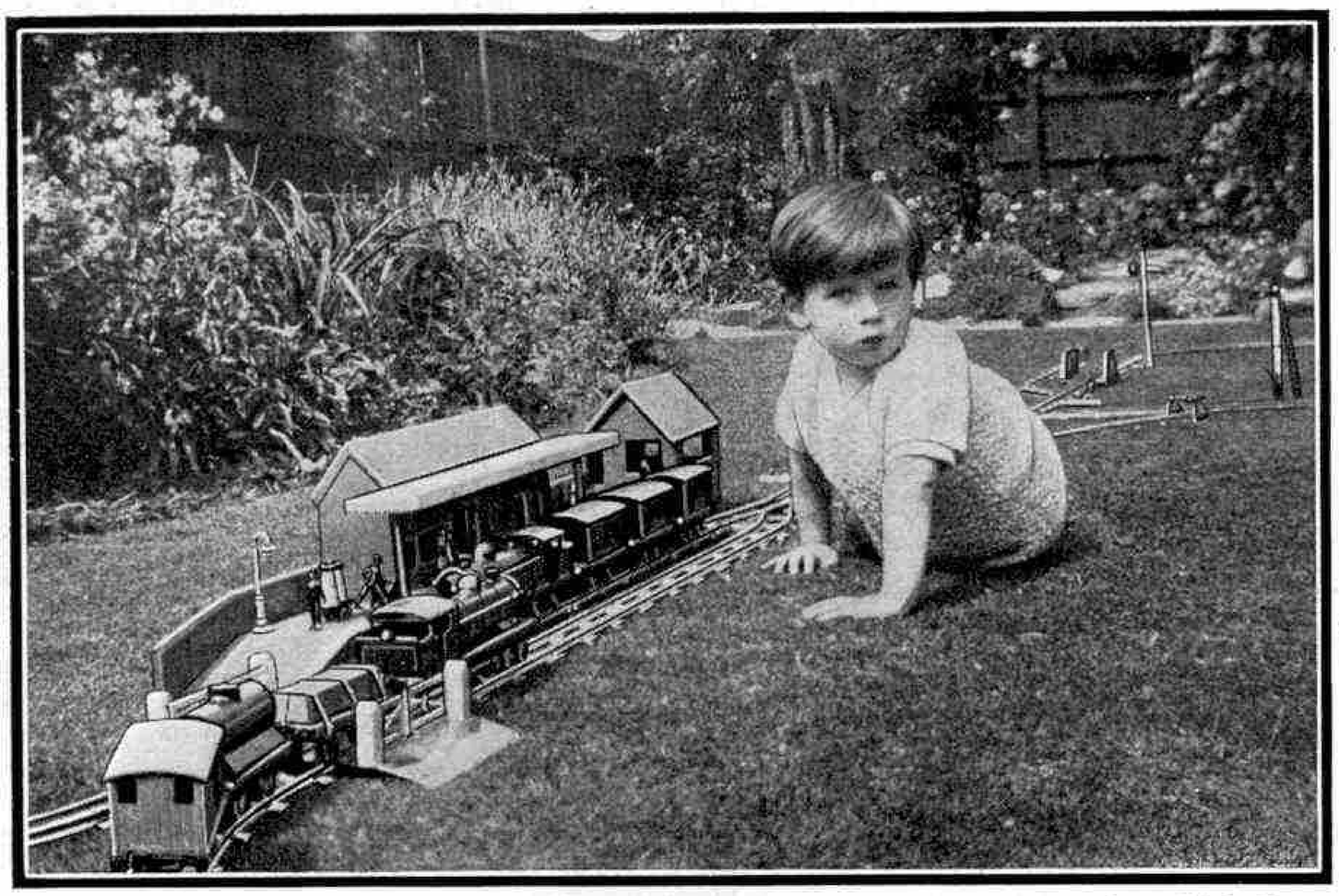
VACUUM PIPES.—Vacuum pipes will be included in the details reproduced on our revised locomotives. (*Reply to D. Wells, Taranaki, New Zealand*).

ELECTRIC GOODS LOCOMOTIVE.—Your idea for an electric goods locomotive is quite good, and will be carefully considered. (*Reply to J. Finley, Manchester*).

REVISED PARALLEL POINTS.—Your suggestion for parallel points composed of one straight rail and one curved rail is interesting, and will receive our consideration. There certainly are advantages attached to the use of this type of points, and it is fairly common in actual railway practice. (*Reply to R. G. Bateman, Melksham, Wilts.*).

COLOUR LIGHT SIGNALLING.—The system of colour light signalling may be popular with enthusiasts who possess elaborate electric train sets, but until this type of signalling comes into more general use on our railways we do not propose to introduce it. (*Reply to P. Miller, Manchester*).

SLIP COACH.—As we already stated, we are at present experimenting with a coach of this type, and we shall make an announcement regarding it in due course. (*Reply to R. P. Taylor, Woodbridge, Suffolk*).



Summer days in the garden. A section of a splendid model railway, in which Ian Buchanan (H.R.C. No. 577) and his two brothers take great pride

BUFFER BEAM NUMBERING.—You will no doubt be pleased to learn that buffer beam numbers will appear on the appropriate locomotives that have recently been redesigned, and will shortly be on the market. (*Reply to W. Dansdon, Cape Town, South Africa*).

DOUBLE BUFFER STOPS.—We are afraid that no advantage would be gained by having double-track buffer stops, as a pair of single ones can be utilised for the same purpose. The great drawback to double buffer stops would be their inevitably large size. (*Reply to A. Lloyd, Ashford, Kent*).

WATER-TIGHT PETROL TANKS.—We are afraid that the existing petrol tanks cannot be made with water-tight joints and screw man-holes such as you suggest. In order to do this the wagons would have to be specially constructed with non-rusting material and this, of course, would considerably increase their cost. (*Reply to J. L. Morris, Newport, Mon.*).

HORSE BOX.—We have had several requests for the introduction of a horse box and we shall probably include a model when we revise our present rolling stock. (*Reply to I. Johnstone, Hastings, New Zealand*).

No. 2 OPEN WAGON.—As this type of wagon appears to be in some demand, we shall give this suggestion careful attention. (*Reply to D. Rockel, Masterton, New Zealand*).

COAL STACKS.—Model coal stacks would undoubtedly add greatly to the appearance of miniature sidings, especially if placed close to the engine sheds. We shall give your idea careful consideration, but in the meantime we suggest that it would not be difficult to make this type of accessory for yourself. (*Reply to T. Hurst, Leamington*).

AMERICAN TRAIN SET.—At present we have no intention of manufacturing an American train set, as we do not consider that it would be sufficiently popular to justify its cost. (*Reply to J. Christie, Garstang, Lancashire*).

LOWER BUFFER BEAMS.—We are interested in your suggestion that Hornby buffer beams should be brought lower. We agree that this would improve the appearance of the vehicles, but it would entail the revision of the whole of the present rolling stock. (*Reply to J. Murray, Windermere*).

THREE-WAY POINTS.—These would be very complicated and most difficult to manufacture. The cost of them would be far too high to justify our producing them. (*Reply to H. Tonks, Formby, Lancs.*).

OUTSIDE "LIVE" RAIL.—We consider that the centre "live" rail system for electric trains is by far the simplest, and so we do not propose to adopt your suggestion for manufacturing track with outside "third rails." (*Reply to W. Frost, Wimbledon*).

SOMERSAULT SIGNAL.—As this type of signal is not extensively used in this country, we do not think it would be advisable to make a special model of it. (*Reply to F. Avis, Westham*).

OBSERVATION CARS.—An open end observation car would certainly be an attractive model. The objection to its introduction is the fact that it is a type that is comparatively rare on British railways. (*Reply to E. I. Dudmore, Birmingham*).

"OO" GAUGE RAILWAY.—We have specialised in "O" gauge, and we do not propose to adopt any other. (*Reply to V. Chancellor, Guildford, Surrey*).

DOUBLE TRACK ACUTE CROSSING.—A crossing of this type is very uncommon on actual railways, and we do not think it would be a popular addition to the Hornby system. (*Reply to F. J. Burge, Blackpool*).

TUNNEL IN DETACHABLE SECTIONS.—Your idea for a tunnel in detachable sections is quite good and will receive consideration. (*Reply to D. G. Brock, London, S.W.6*).

STATION NAME BOARDS.—We agree that station names of the L.M.S., G.W., and S. railways would be a popular addition, and the idea will be carefully considered. (*Reply to W. H. Race, Tonbridge, Kent*).

BOGIE PASSENGER COACHES.—The idea of repainting the Metropolitan coaches to represent the railway groups is quite novel. We have received a number of suggestions regarding the introduction of an eight-wheeled passenger coach, and this will be carefully considered at the earliest opportunity. (*Reply to P. D. Fenn, London, S.E.*).

SIX COUPLED TANK ENGINE.—We are now revising the design of our existing locomotives, and cannot undertake the introduction of another new model at present. No doubt a tank engine of this description would be a very popular addition to the Hornby System. (*Reply to G. S. Harvey, London, S.W.*).

HORNBY CUTTING.—We were interested in your suggestion for a railway cutting for use in Hornby layouts. We doubt whether the idea would prove particularly popular, however, for the type of cutting required varies with almost every layout, and the majority of Hornby enthusiasts prefer to construct accessories of this kind for themselves. (*Reply to W. Williams, Bangor, N.W.*).

ACCUMULATORS IN TENDERS.—Your suggestion regarding the possibility of mounting an accumulator in a tender of an electrically-driven locomotive, which would thus be converted into a self-contained power unit carrying its own source of energy about with it, is interesting. We fear that the idea is scarcely practicable, however, owing to the very heavy weight that the engine would be required to pull. The present system of power transmission by "live" rails permits the trains to be controlled from switches outside the track, thus adding considerable interest to the working of the railway. (*Reply to A. Scorgie, Aberdeen*).

AUTOMATIC COUPLING FOR ROLLING STOCK.—The introduction of a system of coupling and uncoupling wagons automatically would certainly add interest to the Hornby System, but we fear that it would prove somewhat complicated and expensive. However, we shall keep the idea before us. (*Reply to George Fraser, Edinburgh*).

WATER TANKS FOR LOCOMOTIVES.—We are interested in your proposal that locomotive tenders should be fitted with miniature water tanks provided with filling holes and taps, but we fear that an addition of this kind would considerably increase the cost of the tenders and serve no useful purpose. The same objections apply to the question of fitting side tanks to tank engines. (*Reply to W. Dodd, Bradford Yorks.*).

TRAIN BRAKES.—The advantages to be gained by fitting brakes in the guard's and brake vans are not sufficient to justify the great increase in cost that these additions would necessitate. (*Reply to T. Somers, Dover*).

More Details of Prize-winning Models in the £100 Competition

By Frank Hornby

Motor Cycles Prove a Popular Subject in All Sections

AS will be gathered from the previous articles dealing with the entries submitted in "Home" and "Overseas" Sections of the Grand £100 Model-building Contest, the subjects chosen by competitors embraced practically every branch of engineering. Certain subjects, however, received much greater attention from model-builders than others. Motor cars and aeroplanes, to quote two examples, were reproduced in hundreds.

Another popular subject chosen by competitors was the Kerr Stuart Diesel Locomotive described in the January "*M.M.*", and I hope to be able to publish at an early date details and illustrations of some of the outstanding reproductions of this engine.

One of the most striking features of the Contest, however, was the marked predominance of model motor cycles and push cycles amongst the entries, and as there are unquestionably a large number of Meccano boys who are keen followers of the latest developments and innovations in the motor cycle world, I have pleasure this month in illustrating a selection of the more outstanding examples in this category, and will deal with a few of them in detail.



Six further prizewinners in the Home Sections of the Contest. They are (from left to right): R. S. Miller (1st Prize, tie, Section A), C. K. Kernahan (2nd Prize, tie, Section A), (top centre) Peter Fontaine (2nd Prize, tie, Section C), (bottom centre) J. A. Rodriguez (1st Prize, tie, Section C), Eric Whalley (1st Prize, tie, Section A) and Fred Miller (3rd Prize, tie, Section A)

Quite one of the most excellent examples was the "speed bike" built by A. A. Mariani, two views of which machine are shown at the bottom of this page. A glance at these photos will leave no room for doubt as to the type of cycle the model is intended to represent, for its graceful and racy appearance at once proclaim it a super speed machine, while the lifelike attitude of the Meccano figure on the saddle further increases the impression of speed!

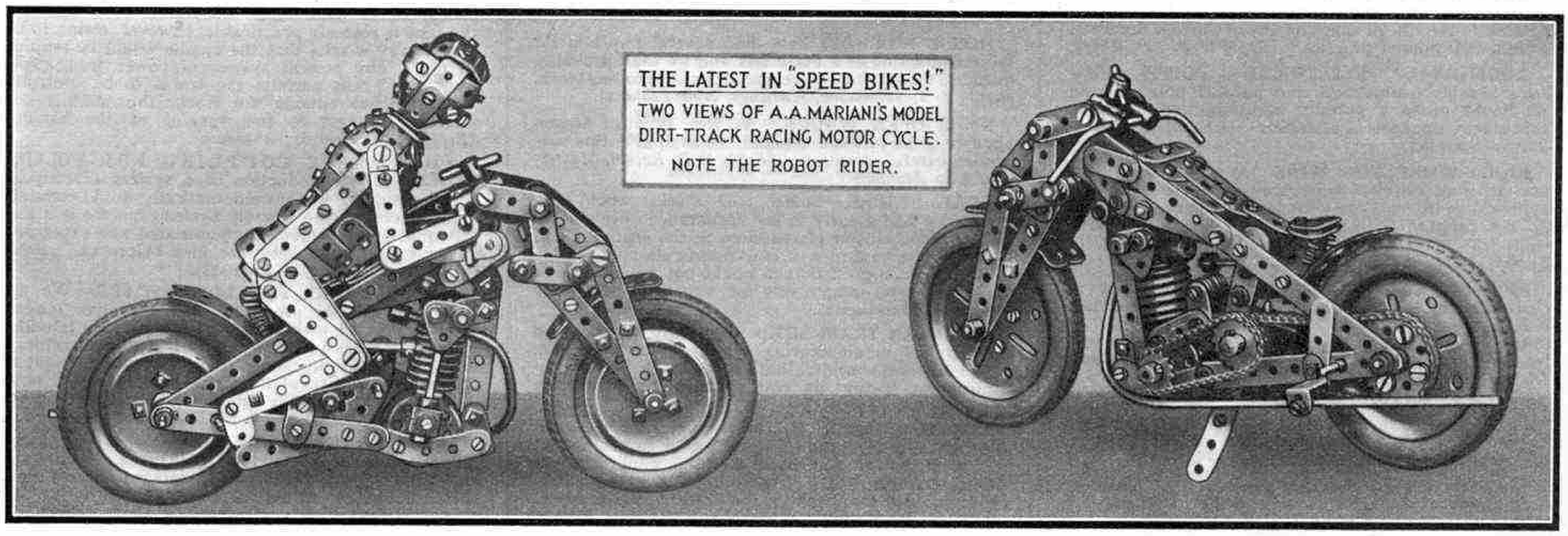
The fittings of this splendid model have been designed most carefully and the cycle is remarkably complete. The steering head is equipped with a damper that can actually be adjusted so as to 'damp' the movement of the steering column. The damper is controlled by a wing nut that can be seen fitted to the top of the frame between the handle bars, this nut being composed of a Threaded Boss and two Threaded Pins. A length of Threaded Rod is secured in the Threaded Boss, and upon rotating the latter, the bearings in which the steering column is pivoted are drawn together, thus producing friction and damping the sideways movement of the front wheel. The forks, incidentally, are sprung from the frame in a manner very similar to that employed in an actual machine.

The main portion of the frame is designed on the "cradle" pattern, the upper portion including a representation of a saddle tank. Note should be made of the almost complete absence of mudguards. Evidently the rider of such a machine places the reduction of wind resistance and the gaining of speed of paramount importance, and gives but secondary consideration to the protection of his person from mud and dust!

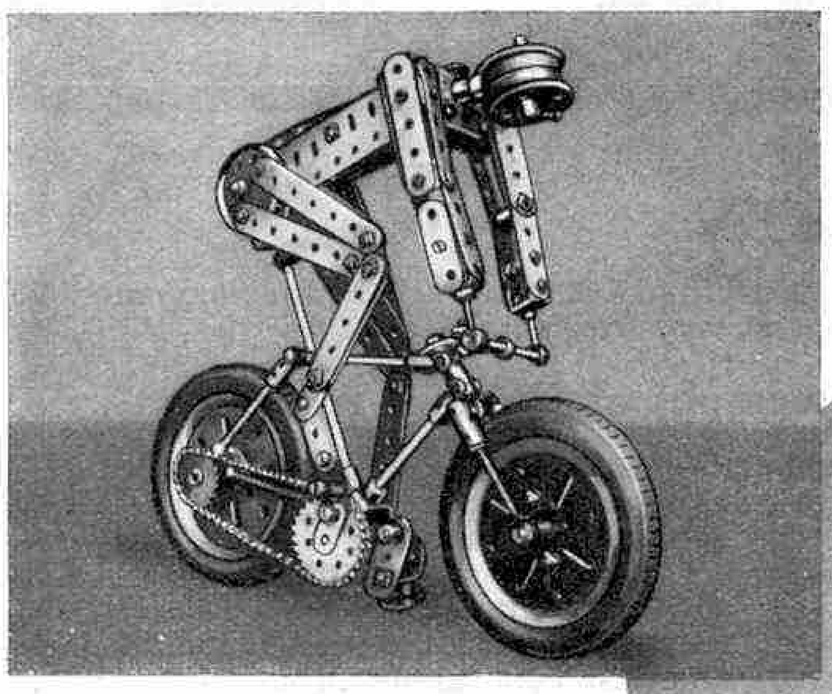
The construction of the engine is another point that should be noticed. It is of the single cylinder type, with the camshaft, which operates the inlet and exhaust port tappets, placed at the top of the cylinder.

The cylinder proper has been built up from a number of Pulley Wheels bolted together, while the crank case consists of two Bush Wheels spaced apart by a number of Double Brackets. The Rod that can be seen passing up the side of the cylinder represents the secondary shaft connecting the crank shaft with the cam-shaft by means of bevel gears, the 1" Triangular Plate and the Double Bracket representing the covers encasing the bevel gearing that is used in the actual machine.

Mention must also be made of the model rider included in the left-hand view. Although constructed entirely from ordinary Meccano parts the figure is curiously lifelike. "*Robot*," in addition to possessing a workmanlike crash helmet, is jointed in no less than nine places! He can thus assume many other attitudes in addition to the one that he appears to have taken up in the photograph—that of grim determination to break the record!



The construction of model motor cycles is by no means a simple task, for in addition to possessing a good knowledge of the features of actual machines, the constructor must also exercise considerable time and ingenuity in fitting the various units into the smallest possible space; it is surprising how difficult it is to fit standard Meccano parts when space is at a premium. Indeed this type of constructional work presents quite a different aspect of Meccano model-building to the completion of a large model such as the Block-setting Crane, etc., and it would be difficult to say which of the two types of construction is the more interesting.



An example of an altogether different kind of motor cycle to the speed bike just described is to be found in the model built by Leslie Smith, and illustrated on this page. The model is intended to represent a powerful V-twin engined motor cycle, which in practice is used to draw a side-car and for touring, and is but rarely employed for racing purposes. The model represents the latest developments in this type of machine and is remarkably complete in mechanical details.

The frame is of the loop pattern while the forks are sprung, and as will be seen, possess a very neat appearance. The frame includes a neat saddle tank, to the top of which is fitted a tool box, while the construction of the rear mud-guard and stays with "kick-up" stand also shows ingenuity.

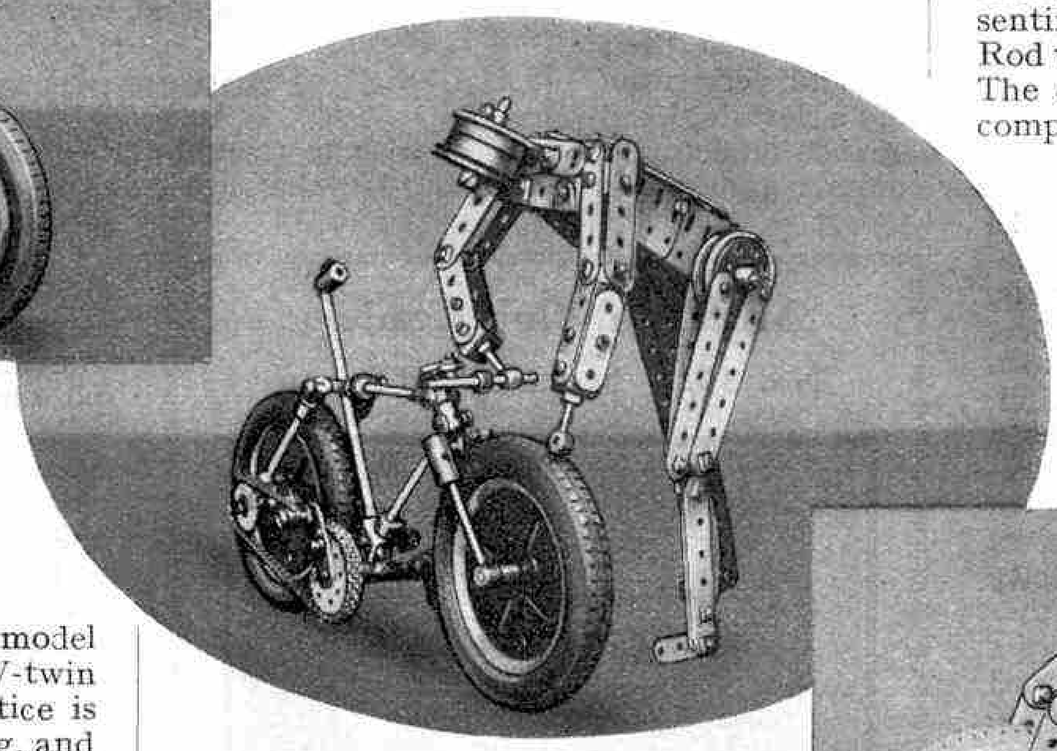
The engine unit has been well constructed but it is, I think, slightly out of proportion. For each of the cylinders mounted in V-formation, a Meccano Worm has been used, but 1" loose Pulleys might have been employed here with an improved effect. The threads of the Worms certainly give an excellent idea of the fins cast on the wall of an actual cylinder, but the Worms are of too small a diameter to conform with other portions of the machine, such as the exhaust pipes, etc.

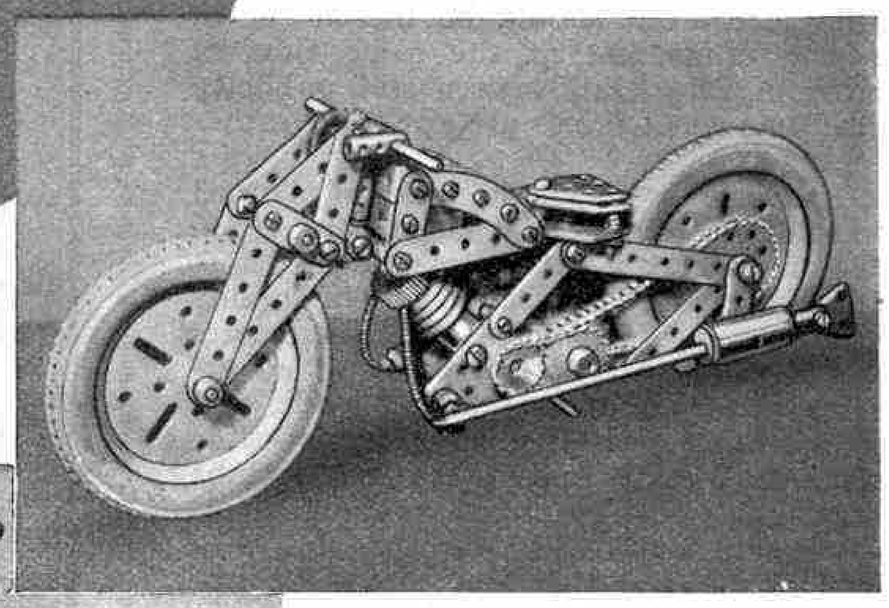
As a whole, however, the model possesses a number of excellent features, and should form a useful guide to those model-builders contemplating the construction of a machine of this type.

The model submitted by Fred Miller was of a racing pedal bicycle. To add further realism and perhaps, a touch of humour, to the machine, Miller also constructed a model cyclist, and the views of the complete model appearing on this page will show how successful he has been in this direction.

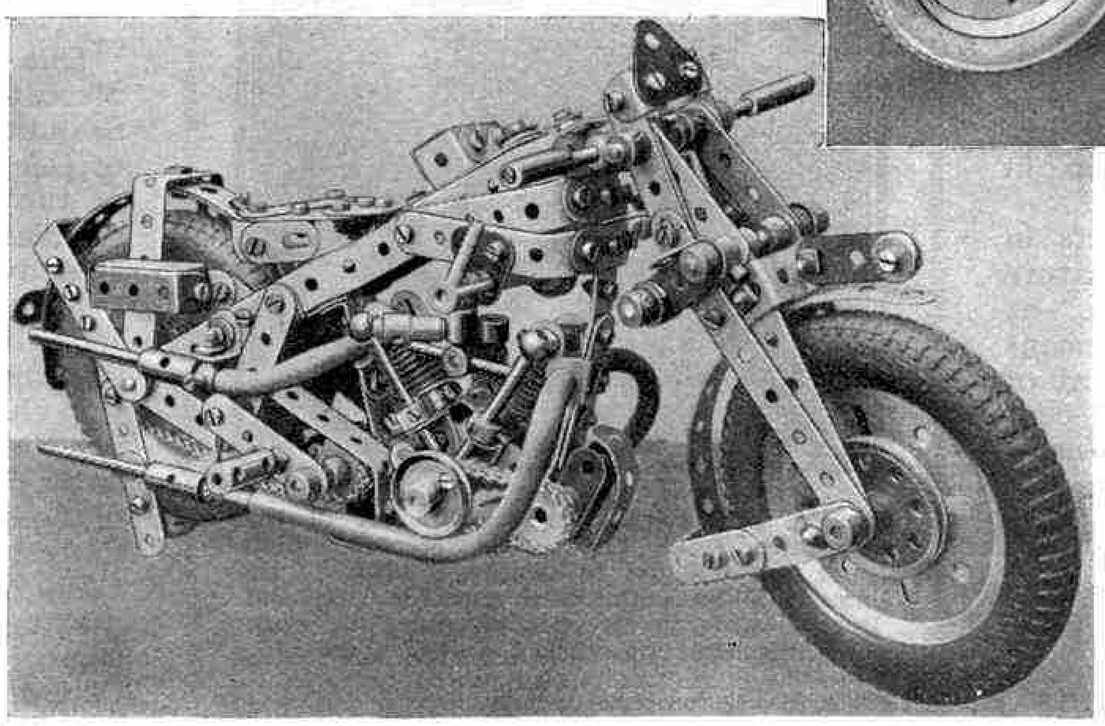
The construction of the frame of the bicycle has been carefully carried out and demonstrates the usefulness of the Meccano small Fork pieces and Couplings in the building of frames of this type. The assembly of the rider is no less ingenious. As will be seen, the "feet" of this weird individual are secured by lock nutted bolts to the pedal cranks of the machine, and consequently on turning the rear wheel the various limbs of the rider will oscillate as though he were actually propelling his mount along!

In the second illustration is depicted an incident that will be well-known to all those who have occasion to use a cycle. The rider, apparently suspecting a puncture, has dismounted, and is testing the degree of inflation of the front tyre. From the illustration, however, it does not appear that the "Dunlop Cord" is in any way deflated!





Top and centre: A Meccano robot cyclist and his machine. Constructed by Fred Miller. Right: A "Super Sports" motor cycle built by R. J. Banks. Below: A powerful "twin" by Leslie Smith



The use of Dunlop tyres, incidentally, lends quite an original touch to the machine, but their size in relation to the remainder of the cycle rather belies the adjective 'racing' in the title of the model. But perhaps it was intended for participation in a comic cycle race!

The machine does not appear to offer much in the way of comfort! The "saddle," for instance, which can be seen attached to the top of the seat pillar in the second view comprises nothing more than a Meccano Coupling! One might well pity the unfortunate individual who was expected to support himself upon this frail and uncomfortable seat!

Turning again to power-propelled machines, the example of a sports model motor cycle built by R. J. Banks will be noted as possessing several distinctive features. The general appearance of the model is distinctly pleasing, and the work is all the more creditable as the finished effect has been achieved with comparatively few parts.

Portions of special interest in the model are the cylinder and the exhaust system. The base of the cylinder as will be seen, consists of a Sleeve Piece, while the upper portion comprises a number of 1" Pulleys surmounted by a 1" Gear Wheel, the teeth of the Gear Wheel giving the effect of the vertical "fins" that in certain cases are cast on the "head" of an actual cylinder.

As the engine is of the two-port pattern two exhaust pipes are fitted, each consisting of a Spring (Part No. 43) representing the bent portion, and an Axle Rod terminating in a cleverly-built silencer. The expansion chamber of the silencer is composed of a Sleeve Piece and two Chimney Adaptors, the (imaginary) exhaust gases finally reaching the atmosphere through a fish-tail consisting of a 1" Triangular Plate held in a Strip Coupling secured on the Axle Rod.

A solo motor-cycle of distinctive design was that entered by E. H. Nash in Section A, the model representing the well-known Scott water-cooled twin-cylinder machine.

The cylinders are represented in the model by Meccano Worms, while a number of Strips and Angle Brackets form the radiator cooling system. A distinctive feature of the actual cycle is the shape and position of the petrol tank, this being cylindrical and secured to the rear down tube of the machine. In his model, Nash used a number of $1\frac{1}{8}$" Flanged Wheels to represent the tank and the effect is particularly realistic.

The model of a single-cylinder machine entered by J. A. Sizer was christened by its constructor, a "Modern Motor-cycle," but in view of the number of novel details included in it, "A Motor-cycle of the Future" might prove a more fitting title! Like a number of other constructors, Sizer employs 1" lose Pulleys for the cylinder, while the crankcase sides are devised from 2" Pulleys. A fitting that gives the machine an excellent finish is the representation of a silencer. This consists of a $2\frac{1}{2}$" Strip

(Continued on page 627)



With the Secretary

Closing the Summer Session

At the end of this month clubs are beginning to turn their attention to preparations for the autumn session, and very often the first thing that brings itself into notice is a more or less depleted exchequer. This is usually the result of the demands made upon club funds for the provision of requisites for summer games and for club outings of various kinds. In order to start the new session well something has to be done to improve matters, and I think there is no doubt that the best plan is to bring the summer session to a close with an outdoor function of some kind. This may take various forms, such as a garden party or sports; and if it is carefully planned it should be the means of raising funds and at the same time of providing the club with useful publicity at a time when things are apt to be rather slack.

The scale on which the affair is planned depends of course very largely upon the size of the club. In any case every effort should be made to enlist the help of parents and friends. Leaders and secretaries should take every opportunity of advertising the event among their friends, and of obtaining assistance in every possible manner. I firmly believe that many clubs lose a great deal by not advertising themselves sufficiently. A Meccano club is a good thing, and this fact should be impressed upon every possible person in the locality.

One of the most important points in regard to an outdoor event of this nature is to provide as many "side-shows" as possible, for these are usually the means of raising quite a respectable amount of money. Without knowing the local conditions it is not possible to make any practical suggestions in this direction, but I shall be very glad to give all the hints I can to any secretary who will let me know the details of any function his club may propose to organise.

The Value of Senior Sections

At the beginning of the first winter session clubs often find that they have lost some of their older members. I think the explanation of this is in many cases that these members have lost interest through having to mix all the time with junior members, and take part in the same competitions, etc. One proof of this is that the clubs that have inaugurated a senior section do not lose members in this manner, and I strongly advise any club that has not already done so to try the experiment of forming such a section. At all ordinary meetings the two sections meet and work separately, but on special occasions, such as lectures, etc., they should unite. A club improves in strength by having a senior section, for the older members are always able to help and advise the juniors, while at the same time they are able to progress in their own way.

In regard to school clubs I should like to see an effort made to retain the membership of Old Boys, even if they are only able to attend meetings at very irregular intervals.

Photographs of Outdoor Activities

I wish to remind club officials of the prizes of £2/2/–, £1/1/–, and 10/6 that are being awarded for the three most interesting photographs showing outdoor activities of Meccano Clubs. The closing date for this interesting competition is 2nd September, and the present month offers the last opportunity of securing suitable photographs.

Many clubs make a practice of arranging excursions to the seaside or country resorts, during this holiday month, and they should not overlook the opportunity of taking photographs of a striking character for entry. It is not necessary that the prints forwarded should be large, or should exhibit any special technical or artistic merit; the chief requirement is that they should be interesting from the club point of view. I strongly urge Leaders and secretaries to make an effort to have their club represented.

Meccano Club Leaders

No. 39. Mr. P. G. Hayman



Mr. P. G. Hayman has been Leader of the Hampstead and Cricklewood Meccano Club since its affiliation in December 1928. He himself is an enthusiastic model-builder, and largely owing to his encouragement the work of members has reached a high standard

Guild in Northern Europe

One corner of the world in which the Meccano Guild is making headway is Scandinavia and the neighbouring country of Denmark. There the aims and objects of the Guild are making an increasingly popular appeal and new members are steadily being recruited.

Meccano boys in these countries are following the example set by Guild members in other lands and forming themselves into clubs for the express purpose of enjoying their hobby in the company of fellow enthusiasts. Denmark had the distinction of possessing the first affiliated Meccano Club in these countries. This was the Odin M.C., formed at Odense, which is making very steady progress. The foundation of this club was quickly followed by that of one at Lidköping in Sweden, and now the circle has been completed by the formation of a club in Oslo, the capital of Norway. Thus each of the three countries is now taking an active share in the development of this world-wide organisation.

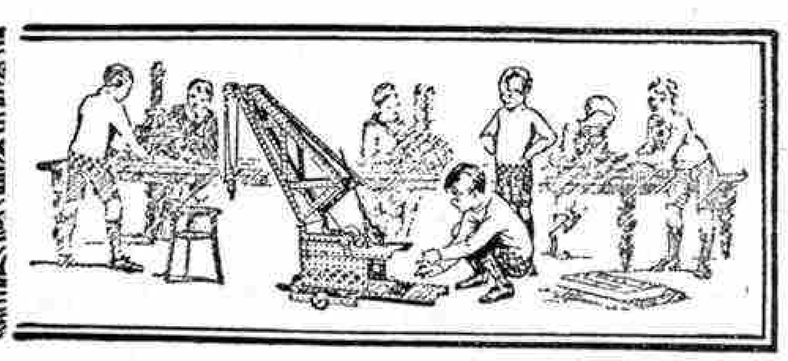
Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters, whose names and addresses are given below:—

BRIDGEND—I. B. Edwards, The Manse, Caeran, Bridgend.
BRIGHTLINGSEA—Kenneth R. Pawle, 141, New Street, Brightlingsea.
LONDON—B. Gill, 25, Kingdon Road, W. Hampstead, N.W.6.
LONDON—G. Willis, 62, High Street, Highgate, N.6.
MORECAMBE—W. H. Marston, Gardener's Bungalow, Lister Grove, Heysham.



CLUB NOTES



Whitgift Middle School M.C.—A party of members visited Southampton. They were conducted over the White Star liner "*Olympic*" and also made a tour of the Docks. A visit to the Croydon Gas Works provided an interesting and enjoyable evening. Club roll: 34. *Secretary*: A. W. Quick, "Wellswood," 87, Sandy Lane South, Wallington, Surrey.

Braintree County High School M.C.—Visits were paid to a local foundry where motor car fittings are made, and to Crittall's metal window frame works. Several Rambles and Cricket Matches have been held, including a fiercely contested game between two sections of the club. Club roll: 26. *Secretary*: P. Allen, St. Edmunds, Bocking, Braintree.

Bramley (Leeds) M.C.—A van decorated by members took part in the local Charity Carnival procession. Cricket and Cycling divisions have been formed. Several Rambles have been held and articles collected by members on these excursions have been used to form a Club Museum. Two extensive Hornby Train Layouts constructed by members have attracted great attention. Club roll: 22. *Secretary*: A. Arundale, 33, Aston Road, Bramley, Leeds.

Bridport Grammar School M.C.—Model-building has been the chief occupation of members, who constructed many models of high standard for exhibition on the School Speech Day. These were judged by the local dealer and prizes awarded. Club roll: 23. *Secretary*: E. Lawrence, 161, St. Andrews Road, Bridport. Dorset.

Chelmsford M.C.—"Free Nights" are very successful, each member building any model he pleases, or carrying out operations with Hornby Trains. Activities on Visitors' Night greatly interested those who attended. A Guessing Competition was held in which visitors joined. A Meccano Clock and other models constructed by members were on view, and prizes for the best of these were presented at the next meeting. Club roll: 28. *Secretary*: G. Flexman, Saracen's Head Hotel Tap, High Street, Chelmsford.

Fulstow Junior M.C.—A large club model of Quebec Bridge has been constructed, each member building a small portion. When ready these were assembled out of doors, the suspended span being floated down on pontoons and raised into position in a most realistic manner—and without mishap! The Wild Flower Competition was won by a member who collected 29 varieties. Sports Night was a great success, a long programme of Flat Racing, Hurdling, Jumping, Cycle Racing and other athletic events being keenly contested. Club roll: 11. *Secretary*: L. Doe, Fulstow, North Thoresby, S.O. Lincs.

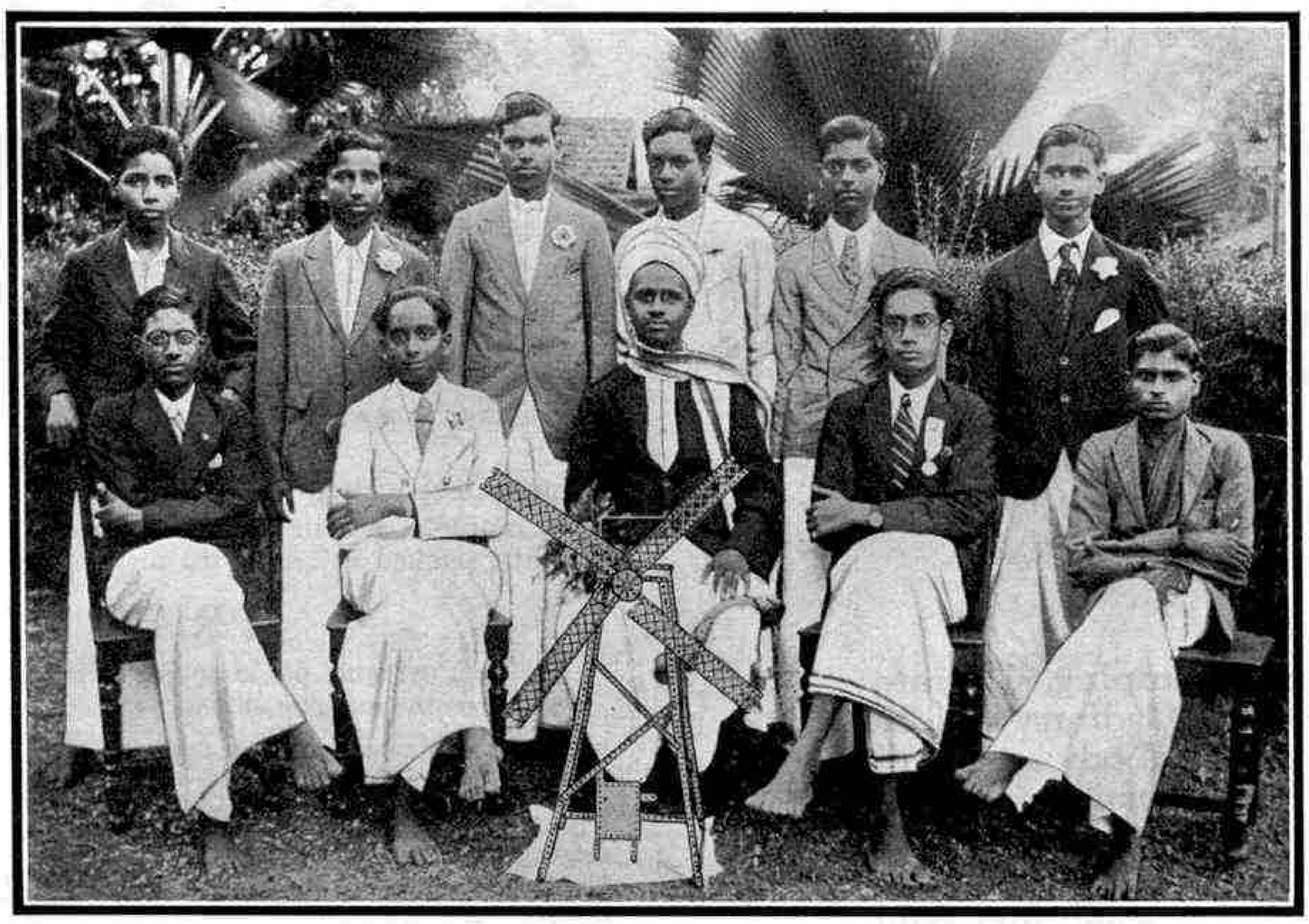
King Edward's High School (Birmingham) M.C.—An exciting Debate has been held on the resolution "*That the Channel Tunnel is a Practical and Advisable Proposition.*" The supporters were outvoted, the principal argument used against them being that the development of aircraft would make the tunnel unnecessary before it was completed. Club roll: 19. *Secretary*: D. H. Lewis, "The Mount," Bilston.

Gaywood (Solihull) M.C.—Many interesting models have been constructed by members of this recently affiliated club. These include a Traction Engine, Roundabout, and Cocoa-nut Shy, and they were on view at a very successful Exhibition. A Photographic Section has been formed. Club roll: 10. *Secretary*: L. V. G. Watson, "Gaywood," Park Road, Solihull.

Pershore M.C.—Cricket and Table Tennis Matches have occupied members' attention; a series of matches in both against Evesham proved very exciting. First prize in a Model-building Competition was won by a splendid geared Crane. A large Hornby Train Layout was constructed for display at the Pershore Flower Show, where it excited considerable interest. Club roll: 11. *Secretary*: D. Cross, Church Street, Pershore.

Exmouth Y.M.C.A. M.C.—Has held a very successful first Exhibition. Models on view included Cranes, Weighing Machines, a giant Motor Bus, and a Meccano Motor Chassis. All working models were demonstrated and explained by members. A large Hornby Train Layout was a special attraction to visitors. Club roll: 26. *Secretary*: J. Bulled, 2, Waverley Road, Exmouth.

Middlesbrough M.C.—A Grand Surprise Evening organised by the Assistant Leader was an excellent Concert to which members invited their friends. Similar evenings organised by the Leader and the secretary took the form of the "*Daily News*" Lantern Lecture, "*The Making of a Modern Daily Newspaper.*" A Mock Trial was very amusing, the prisoner escaping after being sentenced. He was recaptured and duly punished. Three policemen were then tried for permitting him to escape and were dismissed from the force for neglecting their duty! Club roll: 82. *Secretary*: A. Bradley, 95, Deepdale Avenue, Marton Grove, Middlesbrough.



Our photograph shows the members of George Town (Madras) Meccano Club, which was affiliated on 22nd May, 1929. The Leader, Mr. N. Ramaswami Iyengar, B.A., L.T., is seated in the centre of the group. The Club has made good progress, the members being especially interested in Model-building

Weymouth Central School M.C.—At one meeting members were given such tasks as finding a hidden halfpenny; carving a dagger from a given piece of wood; and making a representation of an animal from two potatoes and 12 matches. Great amusement was caused, and prizes were given for the most successful efforts. Other visits have been paid to the local Fire Station and Portland, where an exciting game of Cricket was played. A Table Tennis Tournament and a Games Party were very successful. The Club Camp this year is at Abbotsbury. Club roll: 26. *Secretary*: A. H. Brake, 2, Charles Street, Weymouth.

Whitgift Grammar School M.C.—Lectures on "*The Story of the Motor Car*," "*How to Make Home Talkies*," and "*Electrical Stunts*" interested members very greatly. A Lantern Lecture illustrated by slides on loan from Imperial Airways Ltd., also was given. A Free Gift Evening was very popular, every member receiving a small gift of some kind. It is proposed to form a branch of the H.R.C. in connection with the club. Club roll: 38. *Secretary*: R. T. Furlong, 49, Kilmartin Avenue, Norbury, S.W.

Wallingford Grammar School M.C.—A Mock Parliamentary Election gave rise to an exciting Debate. Mr. J. Moody, President of the Club, gave a very interesting Lecture. At other meetings members constructed models in preparation for the next Exhibition. Interesting visits were paid to the local Gasworks and Swindon Railway Works, and a holiday in Camp has been planned. Club roll: 14. *Secretary*: L. M. Allen, Rosemead, The Moors, Pangbourne.

Holy Trinity (Barnsbury) M.C.—Interesting excursions were made to Elstree and Rickmansworth for boating and fishing. Prize-giving Night attracted a large attendance of parents and members. Prizes were presented to winners of Competitions during the past session by Mrs. Gale-Rew. Club roll: 45. *Secretary*: F. W. Johnson, 23, Market Street, Edgware Road, Paddington, London, W.2.

Ludlow M.C.—The members of the Cricket Team played themselves into form in a series of Trial Matches and are having a successful season. During August members are spending a holiday in Camp on the Welsh coast. Club roll: 19. *Secretary*: A. T. Chester, 8, Castle View Terrace, Ludlow, Salop.

St. Albans M.C.—A visit was paid to the local Waterworks, where members inspected the large pumping engines, one of which alone cost £10,000. Cricket Matches have been played against the Harpenden M.C., and a team of Choir boys from St. Albans Abbey. Recruiting is proceeding satisfactorily. Club roll: 21. *Secretary*: H. M. Upward, Southmead, 19a, Worley Road, St. Albans.

Roe Green M.C.—Games are the chief occupation during the warm weather. These have included a very enjoyable Paper Chase, in which the hares worked on a carefully thought-out plan and put the hounds completely off the scent. Interesting Cricket Matches against local teams also have been played. Club roll: 10. *Secretary*: P. J. Wallis, 1, Elmwood Crescent, Hay Lane, London, N.W.9.

Tynecastle School M.C.—The Leader acted as guide during a visit to the Royal Scottish Museum, where the Hall of Machinery was a great attraction. During the Summer Session alternate meetings take the form of visits to local places of interest, including the Zoo and the Docks at Leith. Club roll: 16. *Secretary*: Wm. Urquhart, West Mill Road, Colinton, Edinburgh.

St. Saviours (Faversham) M.C.—Meetings of this newly affiliated club included Model-building Nights and a very interesting Lecture given by Rev. C. H. Spicer, the Leader of the Club. Excursions have been arranged and members are rehearsing sketches to be presented at Exhibitions and Concerts. Club roll: 12. *Secretary*: A. H. Gregory, 39, East Street, Faversham.

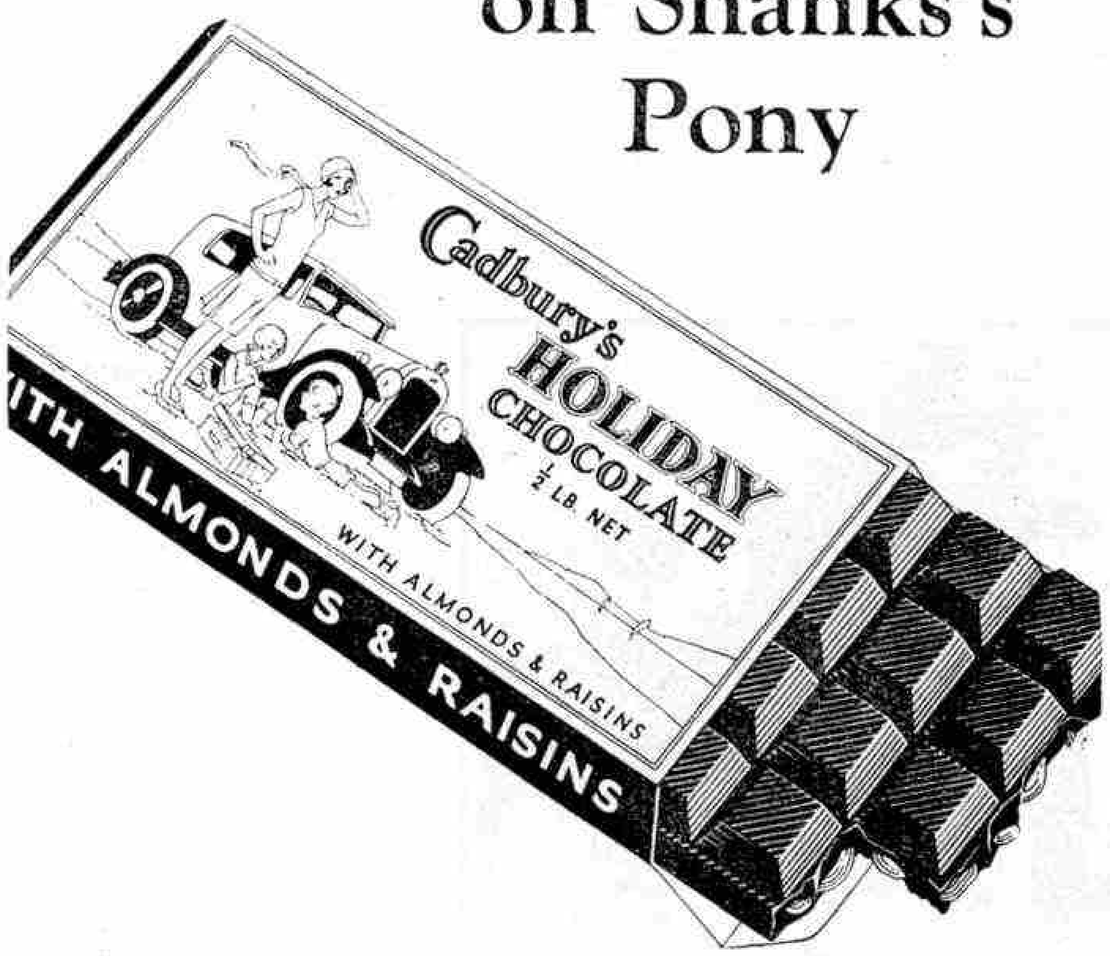
Westbury M.C.—Members visited the Cardington Air Ship Station where they saw the giant airship R.100, which is now nearing completion. It was agreed that the best part of the visit was the climb of 312 steps to the top of the mooring mast! An equally interesting visit was paid to the Henlow Aerodrome. Club roll: 35. *Secretary*: E. D. Move, 24, Burnell Rise, Letchworth.

Hampstead and Cricklewood M.C.—A visit was paid to the Science Museum at South Kensington, where members were specially interested in the pioneer Wright aeroplane. The programme has also included Lectures, Cricket Matches, Rambles, and Picnics. Club roll: 12. *Secretary*: R. Zizolfo, 2, Minster Road, Cricklewood, N.W.2.

Australia

Hobart (Tasmania) M.C.—Debates between sections are frequently held. One on "*Gramophones v. Wireless*" was won after a keen contest by the "Bolts," who championed the Gramophone. An Aeroplane Company offered a prize of a flight in one of their machines to the member who wrote the best essay on aeroplanes. This was won by the secretary. A very successful Exhibition and Concert was opened by the Hon. J. C. McPhee, M.H.A., Premier of Tasmania. The Models on view were the best ever built by members. An extensive Hornby Train Layout, numerous Sideshows, and Entertainments added to the interest of the Exhibition. Club roll: 20. *Secretary*: F. Downie, 50, Letitia Street, North Hobart, Tasmania.

A SHILLING HOLIDAY on Shanks's Pony

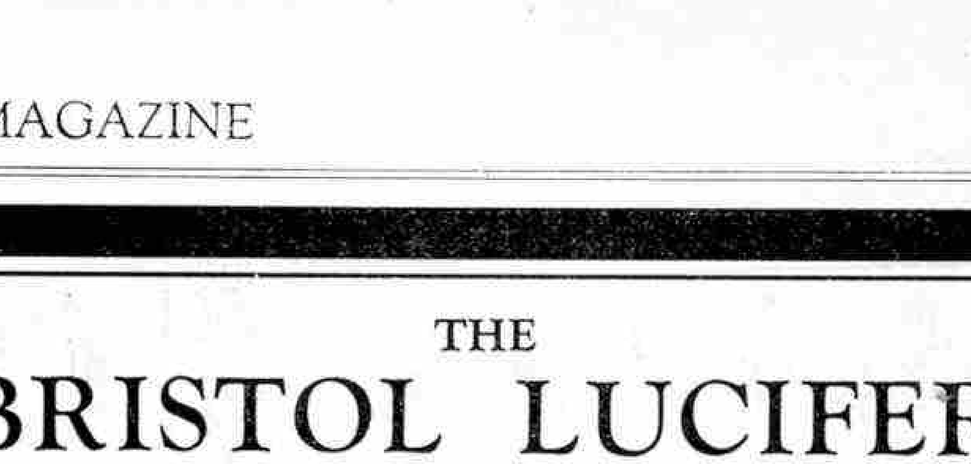


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Dublin.–J. L. Dixon, 14, Suffolk Street.
Edinburgh.–Bassett-Lowke Ltd., 5, Frederick St.
Erdington.–Wright's Toy Stores, 14, High Street.
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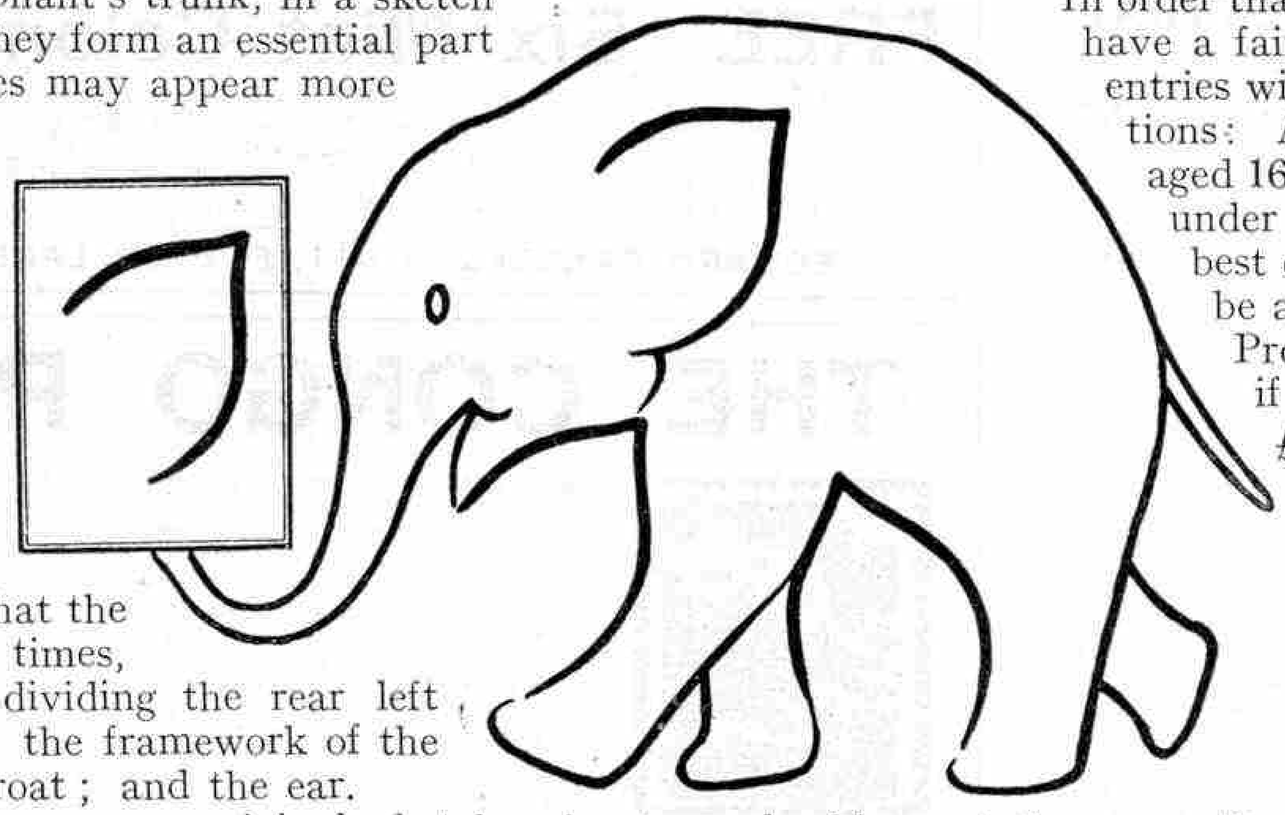
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Competition Page

SKETCHOGRAMS No. 3

In response to widespread requests we announce this month another contest on the same lines as the two very popular and amusing sketchogram competitions that have appeared previously in these pages.

For the benefit of new readers we may explain that the problem is to incorporate the two lines, shown in the box balanced on the elephant's trunk, in a sketch in such a manner that they form an essential part of the outline. The lines may appear more than once, and may be placed in any position desired, provided that their relation to one another is not altered; but they can be turned upside down or tilted to any angle as required. Our artist's drawing shows how this may be done, and it will be seen at a glance that the two lines appear three times, forming the framework dividing the rear left and the front right leg; the framework of the front left leg and the throat; and the ear.



Readers are asked to prepare original sketches in which these two lines are incorporated in a similar manner. The drawing of the elephant, of course, must not be copied, but there are no other restrictions in regard to the nature of the drawing. A bold and simple outline drawing, in which the sketchogram lines are immediately obvious, will have a better chance of success than a more elaborate drawing in which the lines are merely a minor feature. Competitors who succeed in incorporating the lines more than once in one sketch will receive credit for their attempt when the entries are judged, but a good sketch containing only one sketchogram will stand a better chance of success than a poor drawing containing two or more.

In order that our younger readers may have a fairer chance of success, the entries will be divided into two sections: A, for those competitors aged 16 and over, and B, for those under 16. The first and second best entries in each section will be awarded prizes of Meccano Products (or artist's materials, if preferred) to the value of £1/1/– and 10/6 respectively. In addition, there will be a number of consolation prizes. Each competitor may submit as many entries as he wishes, but each must be upon a separate sheet of paper. The name, age and address of the competitor should appear upon the back of each sheet of paper used. Competitors who omit to state their ages on their entries will be placed automatically in Section A.

Entries must be addressed to "Sketchograms No. 3, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 31st August. Overseas, 30th November.

COMPETITION RESULTS

Home

June Crossword Puzzle.—In publishing this crossword we flattered ourselves we had produced quite a teasing puzzle that would give our readers something to think about, but one that would still prove quite fair. Vain conceit. Throughout the month our private postman maintained a constant complaint that crossword puzzles and all other competitions ought to be abolished! Likewise he pleads for the extinction of a Competition Editor who makes things so easy (!) "that any boy could get 'em right." And further, if he were allowed to set the competitions, he'd "show 'em how many beans make five!" From all of which it may be gathered there was an amazing entry. And the majority of the competitors had the correct solution!

In circumstances such as these we always regret the impossibility of awarding a prize to every competitor. The most we can do is to wish every unsuccessful boy "Good luck next time," and to congratulate the fortunate prize-winners upon their superlative luck. The following are the prize-winners: 1. L. Manning (Lytham St. Annes); 2. E. G. P. Martin (Brighouse); 3. R. M. Beck (Abingdon); 4. W. Minns (Durham). Consolation Prizes: D. Tuckett (Co. Down); A. W. Bull (West Bridgford); G. T. Young (Leicester); W. A. Dean (Tonbridge); D. G. Couper (Hendon, N.W.4).

The Overseas section has still a month to run, and it is necessary to withhold the solution until next month.

41st Photographic Contest.—The June Landscape Competition proved one of the most interesting that we have ever held. In point of numbers there have been bigger entries for certain other competitions, but for sheer charm and photographic skill this contest has produced what is probably the best batch of prints it has been our fortune to see.

There was very little to choose between the winning entries in each section. In the A Section a charming view of the "Auld Brig O'Doon" that is mentioned in Burns' great poem "*Tam O' Shanter*" just gained preference over the Kentish scene reproduced on page 661 of this issue. Strangely enough, in the B Section, an open countryside view taken in Oxfordshire scored a narrow win over a well-composed picture of the famous old "Brig O'Balgowrie" in Aberdeenshire.

The complete list of awards is as follows:—First Prizes: Section A, G. E. Barrett (Oxford); Section B, G. Ross (Glasgow); Second Prizes: Section A, W. J. Baker (Tunbridge Wells); Section B, K. R. Matthews (Eastbourne). Consolation Prizes: O. A. Kimmings (East Acton, W.3); C. C. Duce (Hamilton); D. Freeman (Penarth).

Grand
Summer Holiday Contest

Closing This Month

HOLIDAY STORIES
PHOTOGRAPHS
SKETCHES OR PAINTINGS

Special sections in each group for competitors over and under 16, with prizes of £1/1/–, 15/–, 10/6 and consolation prizes in each section.

For full details see page 577 of the July issue.

CLOSING DATES

Home Groups: 31st August.

Overseas: 30th November.

Overseas

Cover Voting Contest.—The voting in this contest showed a remarkable variation from the result arising from the Home section voting. The June cover, however, easily held its position as the most popular of the year.

A pleasing feature of the contest was the exceptionally large entry. In consequence the result may be taken as representative of our Overseas circle as a whole. The big entry naturally made the voting keen, and although nobody distinguished himself to the extent of a completely accurate forecast, several boys came very close.

To enable competitors to check their entries the final order of voting is appended: June, May, February, April, December, March, July, November, January, October, September, August. April and December tied for the fourth place and January and October were equal favourites for the ninth position. For comparison purposes, reference should be made to the Home Section result on page 415 of our May issue.

The prize-winners names are as follows:—1. P. Creswell (Wellington, N.Z.); 2. J. Jessen (Dargaville, N.Z.); 3. R. E. Bernotein (Johannesburg, S.A.); 4. E. H. Weller (N. China). Consolation Prizes: D. Ongley (Transvaal, S.A.); F. B. Whitechurch (Morrinsville, N.Z.); B. C. Bateman (Vaud, Switzerland).

Boat Race Essay.—It is clear from our Overseas readers' enthusiasm for this competition that interest in the famous Oxford and Cambridge boat race is no less keen abroad than at home. Certainly the winning competitors had made a searching study of the history and associations of the race, for they revealed a very close knowledge.

The prize-winners were:—First Prizes: Section A, E. F. Smith (Rosemount, Quebec); Section B, J. Frape (Glenfield P.O., Australia); Second Prizes: Section A, N. F. Keith (Geelong, Australia); Section B, A. H. Godfrey (Nairobi, South Africa).

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THE CONGO PACKET





The Belgians are honouring England's great Explorer, H. M. STANLEY (to whom they owed so much for his work on the Congo) with a special issue of stamps bearing his head. I am therefore offering a packet of *African Stamps only*, representing most of the countries he explored and the adjoining States. ALL are GOOD CLASS STAMPS. NO COMMON Continentals. GOLD COAST, NIGERIA, PORTUGUESE CONGO, a fine set of KENYA & UGANDA, MIDDLE CONGO, EQUATORIAL AFRICA, QUILEMANE (ZAMBESIA), IVORY COAST, RUANDA-URUNDI, RHODESIA, NIGER, ANGOLA and many others. Price 4½d., postage 1½d. extra. In addition to this I am presenting all who ask to see my approval sheets a SPLENDID set of **10 CONGO** (ncluding the Stanley Stamps) usually sold at 1/-. Senders of addresses of stamp-collecting friends will receive a free set in addition. List of 700 sets and packets, **1d.** extra.

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These are genuinely clean, selected Stamps and of value to any collector. This unparalleled offer I am making to advertise my cheap approvals.

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A grand packet of **25 Different Stamps,** containing **Sardinia,** unused; **San Marino** 1929 New Pictorial; **Transvaal, 1896, 1d.,** unused, a fine stamp; **Morocco Agencies,** unused; **N. Borneo,** pictorial; **Guadeloupe,** new issue; **New Caledonia,** new issue; **Kouang-Tcheou; Travancore,** unused; **Cape of Good Hope; Martinique; St. Pierre** and **Miquelon; New Zealand,** Admiral; **French Morocco; Dahomey,** etc., free to all asking to see my famous approval sheets and enclosing **2d. for postage and packing (abroad 3d.).**

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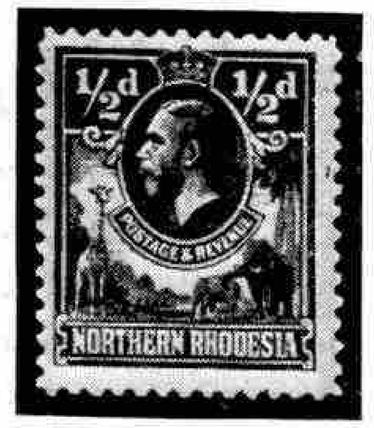
Packets All Different Post Free

24	Esthonia, mint and used	10d.
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THE STAMP SUPPLY,
42, Clarence Road, St. Albans, Herts.



Stamp Gossip



Unworthy Stamps

With a united voice the British philatelic press has condemned the current Postal Union Commemoratives. But at least there is the consolation, such as it is, of knowing that things might have been worse, for the stamps leave nothing to be desired on the score of production. Our friends in France are much more badly served, for most of their current stamps, both mother country and colonials, are very poorly printed, although in the majority of cases, particularly among the colonial issues, the designs are first class.



The recent Joan of Arc commemorative, reproduced here, is an atrocious insult to the memory of the "*Maid of Orleans.*" Few of our readers will need a recount of the story of Joan of Arc. The stamp itself commemorates the 500th anniversary of the recapture of Orleans from the English on 8th May, 1429, by a French army under the leadership of this wonderful girl. Joan of Arc was only 19 years of age when, after a trial that was a travesty of justice, she was burnt at the stake as a sorceress and a heretic, two years after her triumphant entry into Orleans!

Finnish Commemoratives

The strong sense of civic pride that stirs our Continental neighbours is clearly indicated by Finland's recent issue of a short set to commemorate the 700th anniversary of the foundation of Abo, the second largest city in Finland.

Abo is a seaport of approximately 60,000 inhabitants, and our illustration of the one mark value shows a steamship, the s.s. "*Bore,*" leaving Abo Harbour, and in the background Abo Castle, which is itself the subject of the 2m. design. The remaining value, 1½m., depicts Abo Cathedral.



Most of our readers will be familiar with the word *Suomi*, the native rendering of the name Finland, but *Turku* may be puzzling. It is the Finnish equivalent of Abo.

Australia's Air Mail Stamp

What is probably one of the most striking air mail stamps yet issued was placed on sale in Australia on 20th May last. As our readers will note, the design shows an Australian pastoral scene, with sheep and gum trees, and in the distance a mountain range. Across the vast space a D.H. aeroplane is flying. The whole suggests, in a pleasing manner, the air machine's conquest of time and distance. The colour adopted is mid-green and only one denomination, 3d., is to be issued for the present.



The Australian air mail service charge is 3d. per half-ounce, pre-payable by air mail or ordinary postage stamps, irrespective of the distance to be covered in Australia or the number of air routes traversed. All types of mail matter, other than parcels, are carried.

A specially interesting feature of this stamp issue is that two leading Australian philatelists were called into consultation over the design. Great Britain, please copy!

Stampless Times

The days of 1840, when postage stamps were not, and when postmasters had to personally supervise the mailing of each letter, indicating the amount of postage in pencil, were recalled to the Boston Philatelic Society in a recent address by Mr. A. B. Slater. The lecturer exhibited stamps issued privately by the Providence, Rhode Island, postmaster in 1846, for the convenience of his patrons. Actually the first stamp in the United States was the private one of the New York postmaster in 1842. Other city postmasters followed, with Providence sixth in line.

It was not until 1847, Mr. Slater said, that the Federal authorities awoke to the convenience of the stamp. In that year came the first official issue, all of the 5-cent variety bearing a likeness of George Washington. He told also of how, 75 years ago, nearly 6,000 of the then obsolete Providence stamps, for which the postmaster charged $1.05 for $1 in stamps, to cover printing costs, were given to children to play with. These stamps, that now sell for as high as $30 apiece, were plastered freely on trees and fences, where they stayed as decoration until the rain washed them into oblivion!

Ireland's First Commemorative

The most interesting recent stamp event was the appearance of the Irish Free State's first commemorative, on Sunday, 24th June, simultaneously with the Dublin celebration of the Centenary of the passing of the Catholic Emancipation Act by the British Parliament in 1829.



Three denominations were issued, 2d., 3d. and 9d., each employing the same design, embodying a portrait of Daniel O'Connell, the great Irish politician and barrister who made the liberation of Irish Roman Catholics his lifework.

Subsequent to his first Parliamentary triumph, the Emancipation Act, O'Connell turned his attention to the repeal of the Act of Union between Ireland and England. His efforts in this direction landed him before the British Courts on a charge of seditious conspiracy, but after conviction by the lower Court the Appeal Court gave judgment in his favour. Before he died, in 1849, while on a pilgrimage to Rome, O'Connell had sowed the seeds of what is now the Irish Free State.

The inscription in the belt surrounding O'Connell's portrait is in Gaelic, and means Catholic Emancipation.

The extraordinary scenes at the Dublin celebrations will always lend special interest to these stamps. At a religious ceremony held in Phoenix Park between 450,000 and 500,000 people took part! The procession to the Park consisted of nearly a quarter of a million men and women who, walking 12, and sometimes 20, abreast, took more than three hours to pass certain points in the city! Never before in Ireland's history has such a multitude been gathered together.

A Norwegian Mathematician

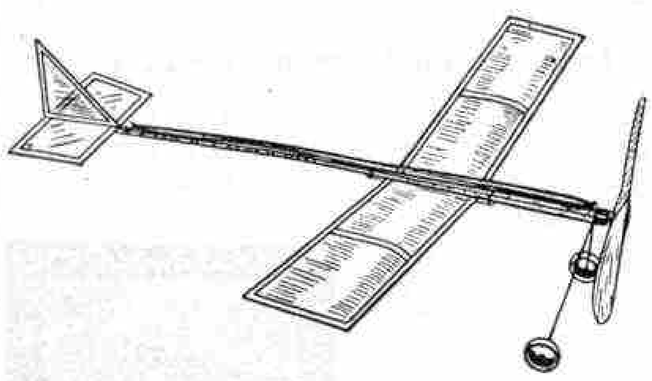
An interesting companion stamp to the Ibsen commemorative issued last year by Norway, illustrated in the July, 1928, "*M.M.*", has been issued to mark the centenary of the death of Niels Henrik Abel, a famous Norwegian mathematician. Like so many other geniuses, he went to an early grave, dying in 1829 at the age of 27. He was chiefly famous for his development of the theory of algebraic equations and elliptical functions.



WARNEFORD MODELS

BRITISH MADE AND GUARANTEED

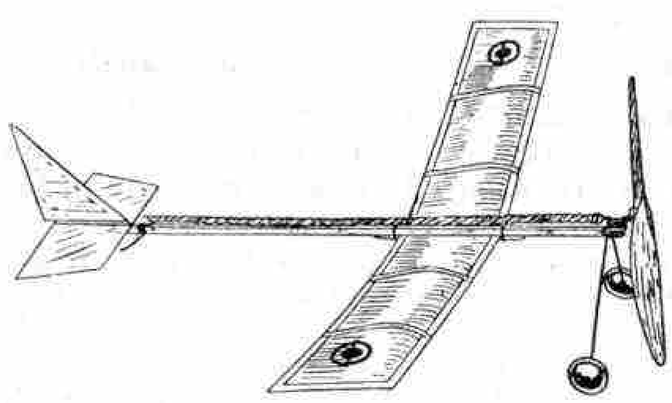
FOR WONDERFUL FLIGHTS AND HOURS OF REAL EXCITEMENT.
They will fly fast, slow, "stunt," rise from the ground and land without injury. The special instruction sheet of rigging and flying, supplied with all Warneford Tractor Models, makes the handling of these machines unique in its simplicity.



THE "MOTH" TRACTOR

A splendid Flyer and beautifully finished. Has an 8″ Hand-Carved and Balanced Propeller and Patent Shock-Proof Chassis.

Price 4/6



THE "DEMON" TRACTOR

Weight and Wind Resistance have been reduced to a minimum in this model, giving the utmost duration of flight. Has a 10″ Propeller and Shock-Proof Chassis.

Price 7/6

The "Racer" Tractor - - Price 21/–
A Fast and Powerful Machine. It is fitted with a Patent Twin Gear Rocking Bracket and Reinforced Wing.

"The Wilfly" Pusher-Type Mono Price 1/6
15″ long and weighs less than ¾ oz. A Splendid Flyer.

The "Swift" Tractor - - Price 10/6
For Long and Steady Flying this Machine cannot be beaten, and though of large dimensions is very easy to handle.

FORM A FLYING SQUADRON AT YOUR SCHOOL

Obtainable in London from the following Stores: Messrs. Harrods, Gamages, Army and Navy Stores, Barkers, Shoolbreds, Peter Robinson's, from all the Branches of Hamley Bros., Hobbies, Spaldings, and from most good Stores and Toy Shops throughout the country.

SOLE MANUFACTURER: F. J. MEE, GREENWICH ROAD, LONDON, S.E. 10 PRICE LISTS POST FREE

Make your "Snap" Album look distinguished!

You can excite the envy of your friends by means of

TRADE MARK 'TABLOID' BRAND TONERS

BLUE GREEN SEPIA

which enable you to obtain beautiful colour effects quite simply

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The price advantage of Criterion Plates enables you to take the other view also. 3¼ × 2½, 1/3 doz.; 4¼ × 3¼, 1/10 doz. From your dealer or Post Free. CRITERION LTD., STECHFORD, Warwickshire.

This Space is set to ½ inch s.c. and costs 8/– per month. The sum is the 50th of £20, the price of a whole page advertisement. Over 69,000 copies of the March issue were sold in various parts of the world. Your advertisement therefore reaches this exclusive public for approximately 1½d. per 1,000.



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Beautiful Effects.

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COMPLETE WITH MASKS and CHEMICALS, price 1/– per packet
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On receipt of 1/– P.O. we will send you One Packet, together with particulars of Our DAYLIGHT PAPER COMPETITION
Several Cash Prizes

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MECCANO WRITING PADS are supplied in two sizes, each consisting of 50 printed sheets of tinted paper with cover. Prices—Large, 1/– each, and small, 6d. each (post free), from Meccano Ltd., Old Swan, Liverpool.



No matter what the weather conditions—you will get the best results with

BARNET ROLL FILMS

THERE IS A SIZE FOR YOUR CAMERA

ELLIOTT & SONS LTD., BARNET

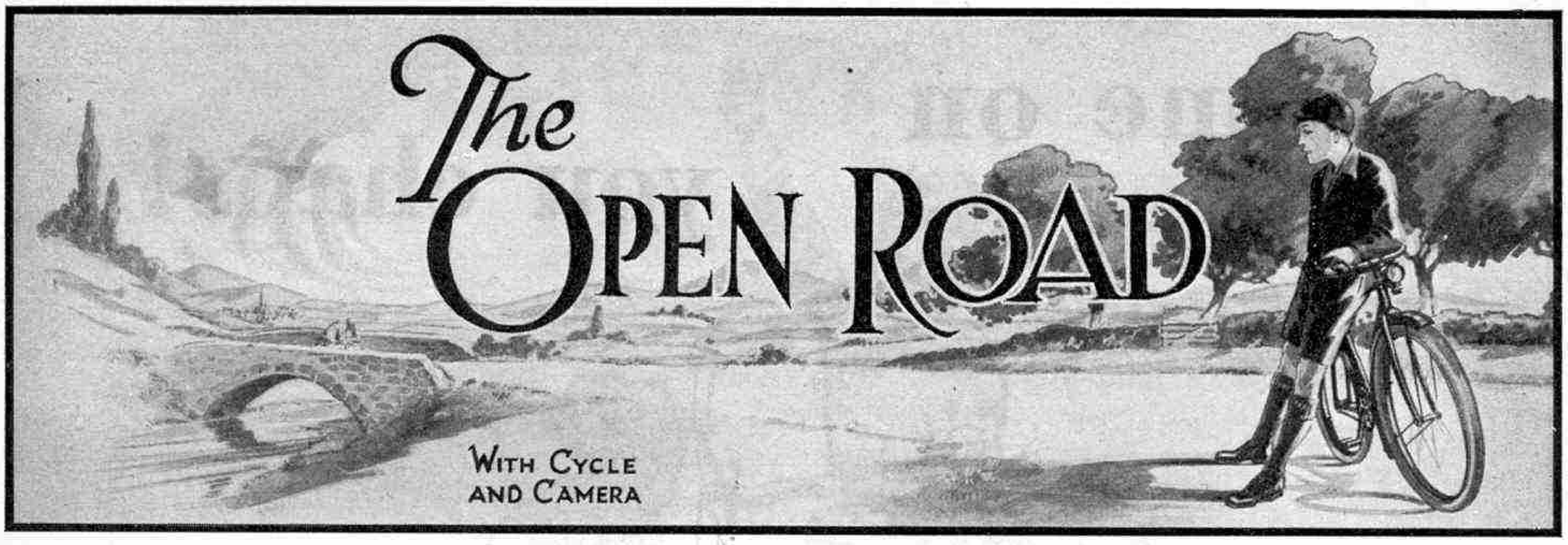
MECCANO ENAMEL

Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red, grey and green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts.



Price per tin 8d.

Meccano Ltd., Binns Road, Old Swan, Liverpool



Photography

HANDLING THE CAMERA

Every year thousands of snapshots are spoiled by lack of attention to a few points. These are all very simple, but any one of them is liable to prove the cause of failure.

One of the commonest errors is that of jarring the camera at the instant of exposure, with the result that the picture is hopelessly blurred. If a box-form camera is being used the best method is to press the camera firmly against the chest and hold the breath just at the moment of making the exposure. If this method is followed a very small amount of practice will ensure good results.

If a folding camera is being used, and especially one of the vest pocket type, this cannot very well be done, but even here there should be no difficulty provided the shutter is manipulated in the correct way. The trigger must not be jerked or pressed forcibly, but must be pressed down very gently; in fact the process is best described as one of "squeezing." With proper care to this detail there should never be any signs of camera movement in snapshots of one-twentieth of a second or faster. If a longer exposure than this is necessary, and no stand is available, the camera should be pressed against a tree trunk, gate post, or wall.

Among the entries in our photographic contests are many photographs of buildings, which are quite good in every respect except that the building appears to be falling over backward! This fault, which quite ruins the picture, is the result of pointing the camera upward in the endeavour to include the top of the building. It is impossible to obtain a satisfactory result by tilting the camera in this manner, and the only alternative, if the top of the building is not in the picture when the camera is held level, is to move farther away until the whole is included.

When changing films out-of-doors this should, if possible, be done in the shade in order to avoid any danger of "fogging" a film. If no other shade is available the body should be kept between the camera and the sun. Another important point that is sometimes overlooked until too late is that the covering paper must be loaded into the empty winding spool so that it is perfectly level and will wind on freely.

We frequently receive inquiries as to the cause of mysterious horizontal lines running across photographs taken with folding film cameras. These lines are very unsightly, and spoil the effect of an otherwise good picture. The defect is usually the result of winding on films with the camera bellows closed instead of extended. When a camera is shut there is a danger that the bellows may be pressing against the film, and if this is wound on while in this condition bad markings are almost certain to be caused.



"MOTHER AND SON": This charming picture, taken in Kent by W. J. Baker, of Tunbridge Wells, secured Second Prize (Section A) in the June Landscape Photographic Contest

Cycling

AVOIDING TYRE TROUBLE

Tyre trouble has ruined more cycling tours than were ever washed out in a deluge of rain. If one's tyres go wrong everything goes wrong, and a succession of punctures that have to be repaired on the road forms an extremely trying experience for even the best tempered of us!

It is a mistake to ignore the tyres until a bad puncture occurs, and a little attention from time to time will prove well worth while. Oil or grease should never be allowed to come in contact with the rubber, upon which it has a very bad effect. The outer cover should be examined from time to time for small pieces of grit or stones that have partly embedded themselves in it. These must be carefully removed, and the cuts repaired immediately. A plastic tyre-stopping compound that solidifies very quickly when exposed to air is sold for this purpose, and it is very efficient and remarkably easy to use.

If it is at all possible, an outer cover that is showing serious signs of wear should be replaced before starting out on a tour. This applies particularly to the rear wheel, for it is this that has to bear most of the strain. Very often a rear cover that shows signs of wear may be given a longer life by transferring it to the front wheel, where the strain is much less severe.

Most boys are familiar with the simple method of repairing a puncture if they are unlucky enough to have one on the road. If the position of the fault is easily discovered it may only be necessary to uncover a part of the inner tube. On the other hand if the puncture is small it will probably be necessary to uncover the whole tube before its position can be spotted.

The valve must be taken out first, to facilitate the removal of the tube. It should then be replaced and the tube partly inflated. The easiest method of finding the puncture is to pass the tube bit by bit through a pail or bowl of water, when bubbles of air rising to the surface will soon betray the offending hole. If no water is available, the tube should be passed slowly close to the face, when the sensitive skin will give warning of the slightest stream of air. When replacing the tube it is important to make sure that it is properly in position before attempting to inflate it fully, otherwise a second and much more serious puncture may result!

Road accidents not only ruin cycle tours; they bring them to a definite, sudden and unpleasant end. There would be far fewer accidents on the road if every one exercised simple common sense.

"Safety first" must be the slogan of every touring cyclist, and he will be well advised to take to heart these tips:—Sudden swerving on a greasy road is highly dangerous. Corners must be taken on the correct side and the bell or horn sounded before making the turn. It should be remembered that the sounding of the bell is merely a warning, not an order to clear the road. The cyclist must be ready to give way if the obstacle ahead cannot or will not move.

come on you chaps!



Look at this Fairycycle! With balloon pneumatic tyres; powerful brakes and glittering handlebars—what a bike! What a proud machine to ride! Fancy going out to tea on it! Fancy turning up at school on it! Fancy the other chaps crowding round! Yes, you must wangle a Fairycycle.

Every possible detail of equipment on her. Dunlop balloon tyres for solid comfort, tangent spoke wheels with glittering plated rims; bell, pump, tool bag with real tools; stand, so that she stays upright when not in use, and carrier for the mater's parcels. Moreover, any Fairycycle can be fitted with a flat plate between the saddle and the handlebars showing a realistically painted motor cycle engine! Yes, the No. 8 Fairycycle is a machine in a thousand and is so strongly built that when you are big enough to hand it on to a small brother or sister it will still be well worth handing on.

L. BROS. LTD. LONDON BROS ENGLAND

FAIRYCYCLE ASSOCIATION
Membership free to owners of genuine Fairycycles and badge attached to every machine. Simply fill up the form when you buy your Fairycycle, post it to Lines and you will then become a member. This is the badge of the Fairycycle Association.

FAIRYCYCLE

Fairycycles are made in the following sizes at the prices stated:

Model A.—Well finished in black cycle enamel, ball-bearing pedals and plated handlebars. Dunlop saddle, 12" tangent spoke wheels, ⅜" rubber cushion tyres - **29/6**

Model Ax.—Like Model A, but larger size, with 14" wheels and ⅜" rubber cushion tyres - **33/–**

Model B. — Very suitable for young children being light and easy to ride. Has 12" tangent spoke wheels with ⅜" rubber tyres. Complete with chain-guard, reflector, stand and carrier - - - **39/6**

Model Bx.—As model B but larger size with 14" wheels and ⅜" rubber cushion tyres - **42/–**

Model C.—Raised pattern plated handlebars, has chain guard, stand, carrier, reflector and bell. Cycle pattern rim brake, 12" tangent spoke wheels, adjustable ball-bearing hubs, 1" imitation pneumatic tyres - **49/6**

Model Cx.—As model C but larger size with 14" wheels - **52/6**

Model Px.—As model Cx but with 14" × 1⅜" Dunlop "Kempshall" pneumatic tyres - **55/–**

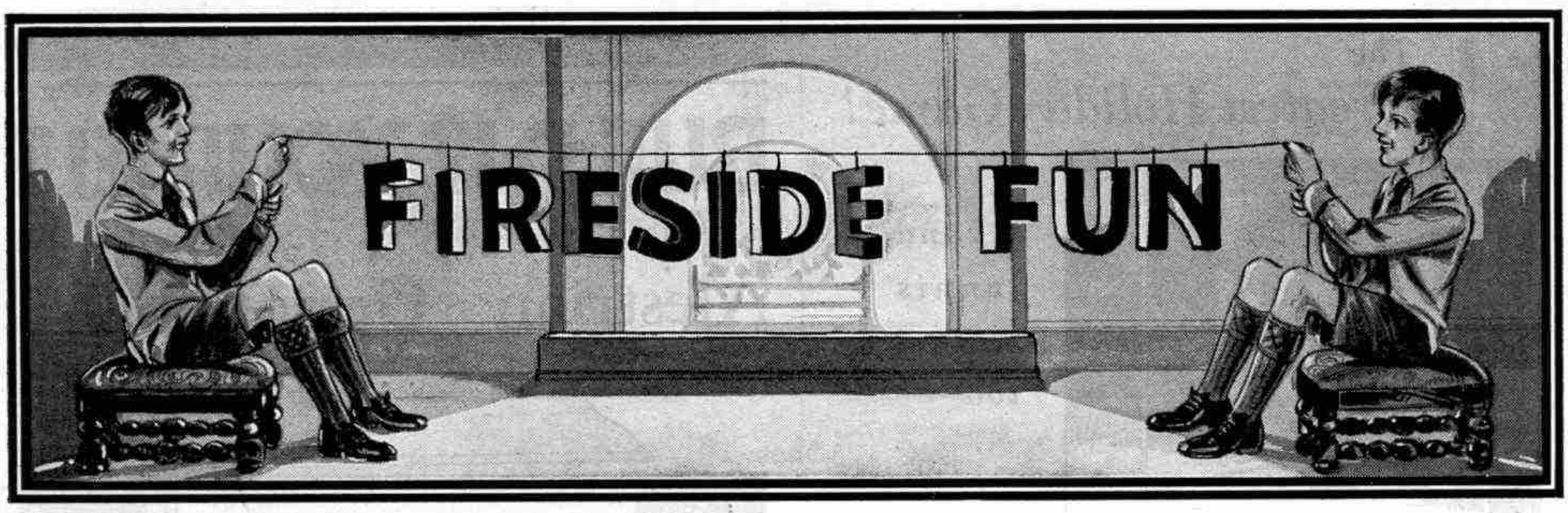
Model D.—Cycle type brakes, raised pattern plated handlebars, 2-coil spring saddle, etc. ½" × ⅛" roller chain, adjustable ball bearings throughout. 12" tangent spoke wheels with 1" imitation pneumatic tyres, complete with chain-guard, stand and carrier, reflector and bell - **59/6**

Model 6.—Strongly built for children up to 9 or 10 years old. 16" tangent spoke wheels fitted 1" imitation pneumatic tyres, adjustable ball-bearings throughout, cycle pattern rim brake. Imitation pneumatic tyres, 3-coil spring saddle, tool bag, bell, etc. - - - **70/–**

Model 8.—The "Rolls-Royce" of Fairycycles, raised pattern plated handlebars, 2¼" buttress tread Dunlop balloon tyres. Plated ball-bearing pedals, tool bag, carrier, stand, bell, reflector and pump, etc. - - **87/6**

All these models with the exception of models A and Ax are finished in black or blue, with gold lines. Fairycycles can be obtained at all good toy shops, or write for illustrated leaflet.

LINES BROS. LTD., MORDEN ROAD, MERTON, LONDON, S.W.19



MORE HOWLERS!

The chief work of the British in Egypt since 1880 has been the extermination of the sphinxes.

The imperfect tense is used in French to express a future action in past time which does not take place at all.

A focus is a thing that looks like a mushroom, but if you eat it it feels different from a mushroom.

Double dealing is when you buy something wholesale to sell retail.

The mechanical advantage of a long pump handle is that you can have someone to help you.

"Ambiguity" means telling the truth when you don't want to.

"Etc" is a sign used to make believe you know more than you do.

* * * *

Mother (to Tommy): "Are you letting little Willie have rides on your scooter?"

Tommy: "Oh, yes, mother. I run it down the hill and he runs it up."

* * * *

"Father," shouted the fisherman's daughter, "come quickly, a gentleman is up to his ankles in the mud."

"Well," retorted the father, "that ain't very surprising; let him just walk out."

"But, father," the girl pleaded, "it's serious—he's upside down!"

* * * *

Bus conductor (picking up coin from floor of bus): "Anybody dropped a shilling."

Woman (hurriedly): "I have."

Conductor (handing her the coin): "Well here's a ha'penny of it, madam."

* * * *

Charlie and Jimmy sat down to their mid-day meal. Both were particularly fond of apples, and on the table there was one nice, rosy apple. Suddenly Charlie began to cry, so his mother asked him what was the matter.

"I'm crying because I'm sorry for Jimmie, as there isn't an apple for him," came the reply.

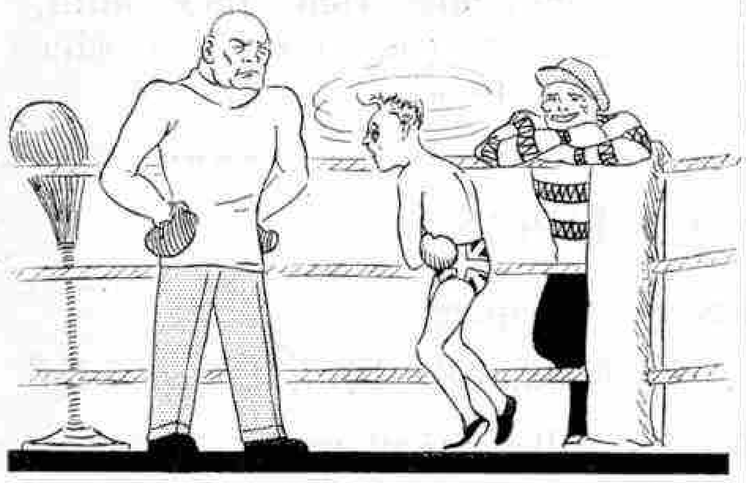
* * * *

A customer produced a very old pair of shoes and asked if they were worth repairing.

"Why, not?" queried the shoe-maker. "The laces are quite good."

* * * *

NO BRUISES BY POST



Teacher at School of Boxing (to newcomer): "Now you have completed your first lesson, is there any question you would like to ask?"

Newcomer (rubbing his bruises): "Yes, can I finish the lessons by post?"

* * * *

Master: "I see Simpson is absent this morning. Does anyone know where he is?"

Jones: "Please, sir, he's in hospital."

Master: "In hospital? Dear me, what is the matter with him?"

Jones: "Well, sir, we had a competition to see who could lean the farthest out of the dormitory window—and he won!"

TAKEN AT HIS WORD

A messenger from the stores hailed a vessel in Southampton docks.

"What do you want?" growled the surly mate.

"Got some vegetables for the ship," was the reply.

"All right—you needn't come on board. Throw them up one at a time," said the mate.

"Ahoy, there! Look out," cried the lad, as he threw a small dried pea towards the mate. "There's a hundredweight of 'em!"

* * * *

THE UPPER HAND



Mother (in train): "Sit still, Tommy, or I'll smack you."

Tommy (brightly): "You smack me and I'll tell the guard my real age. Then you'll have to pay double fare."

* * * *

Father: "Why were you kept in at school?"

Son: "I didn't know where the Azores were."

Father: "In future, just remember where you put things."

* * * *

Faddy Customer: "I don't like the looks of that haddock."

Fishmonger: "Well, madam, if it's looks you're after, why don't you buy a goldfish?"

* * * *

Hotel Manager: "You're a long time blacking those boots."

New Bootboy: "I can't help it, sir. These brown ones don't black easily."

* * * *

Jim: "I heard Tom was hurt, how did it happen?"

Jack: "Well, you see that ditch over there?"

Jim: "Yes."

Jack: "Well, he didn't."

* * * *

First Farmer: "You know I have a lot of horses and my white horses always eat twice as much as my black horses."

Second Farmer: "How's that?"

First Farmer: "Well, I figured it out and the only reason I can give is that I have four white horses and only two black ones!"

* * * *

Jones: "I hear that a man gets run over every half hour in London."

Bones: "Poor fellow."

* * * *

Mrs. Newlywed: "I want to buy some fresh meat, very tender, without any bone, gristle, or fat on it."

Butcher: "Very good, madam—a dozen eggs; and is there anything else I can get you?"

* * * *

"Waiter, will that pie be long?"

"No, sir, it will be round in a minute."

* * * *

Teacher: "Johnnie, name some collective nouns."

Johnnie: "Fly-paper and vacuum cleaners."

* * * *

"How does your new cigarette lighter work?"

"Fine, I can light it with one match now."

CHILLED MEAT

The tramp eyed the joints displayed in the butcher's shop.

"You have meat to suit all purses, I presume?" he said.

"Yes," snapped the butcher.

"What have you to suit an empty purse?"

"The cold shoulder."

* * * *

"Hi! there's a fly in this soup you've just brought me."

"Don't worry, sir, it won't drink much."

* * * *

Smart: "Why does a stork stand on one foot?"

Dull: "I give it up—why does he?"

Smart: "Because if he lifted the other foot he'd fall down."

* * * *

Tramp: "Madam, I was not always like this."

Lady: "No, it was the other arm you had in a sling yesterday."

* * * *

Waiter (to patron who had been kept waiting for some time): "What can I get you, sir?"

Patron: "Well, what I originally came in for was breakfast, but if dinner's ready now, I'll take supper."

* * * *

Physics Professor (after lecture): "Are there any questions?"

Student: "Yes, sir. How do you calculate the horse-power of a donkey engine?"

* * * *

An old farmer once employed an Irishman to work for him. Pat was constantly putting the end boards of the cart on wrong. He would put the front board at the back, and the back board at the front.

One day the farmer printed on each board a large "B," and, calling Pat, he said: "Now, you blockhead, you can't make any more mistakes. That 'B' is for before, and this 'B' for behind."

* * * *

Nigger Judge: "Are yo' guilty or not guilty?"

Prisoner: "Not Guilty."

Nigger Judge: "Then what are yo' doin' here wastin' our time."

* * * *

Some Scouts were about to be drilled alongside a canal.

"Fall in!" commanded the Scoutmaster.

"Two deep!" retorted the Scouts, with one voice.

* * * *

NOT WHAT THE CAPTAIN MEANT!



Captain: "Bit of a swell to-day, sir."

Passenger: "It's very nice of you to say so, but you ought to see me on Sundays."

* * * *

"If you can't do better work I'll have to hire another office boy!"

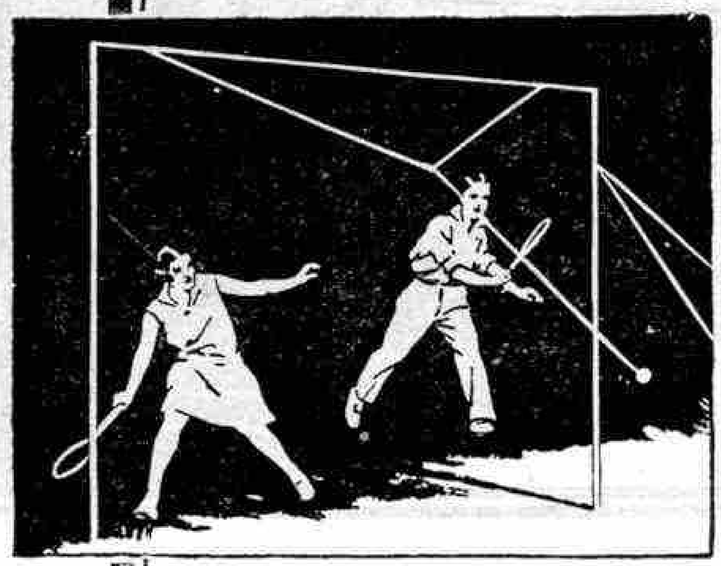
"Thank you, sir. I could get along much better with some help."

* * * *

Boxing Instructor: "That was what is called a half-hook."

Novice (rubbing his jaw): "Well, you can keep the other half."

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. . . and tennis trainer too——

It's fast and furious ! Jolly good fun ! And all the while it's strengthening your tennis strokes ! Kum-Bak is the finest tennis trainer ever invented as well as the best beach and garden game ! Singles or doubles, whichever you please. But you have to be quick to return that whizzing, swerving Kum-Bak ball ! Get your Kum-Bak now, boys ! Send P.O., cheque, or C.O.D. instructions to address below.

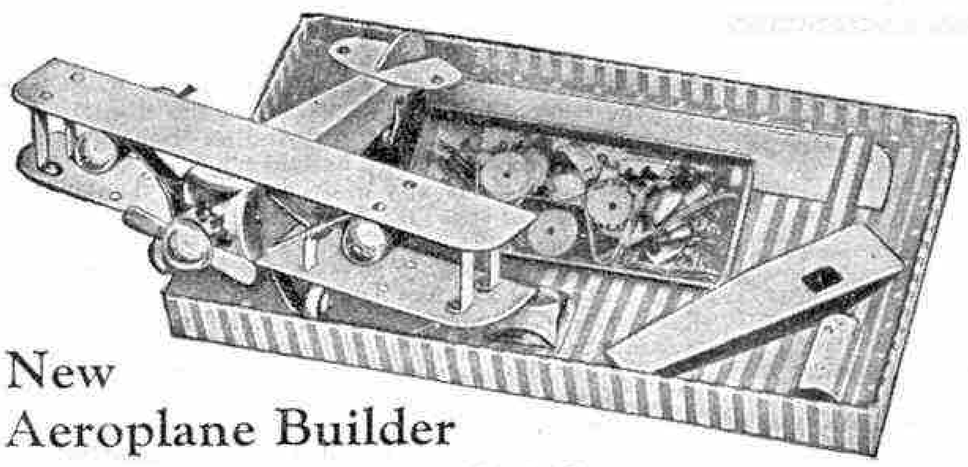
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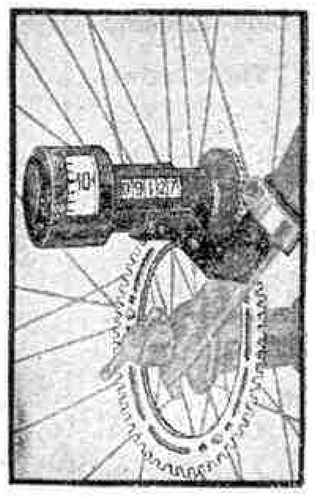


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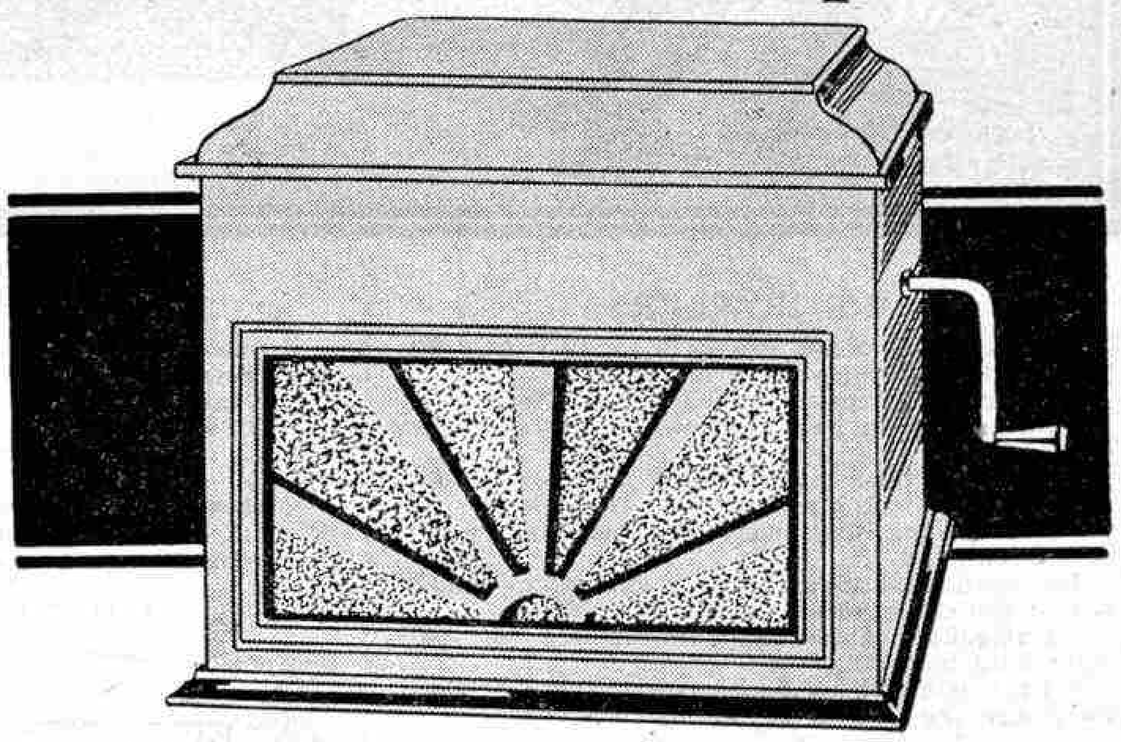
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86/7, High Holborn, W.C.1.
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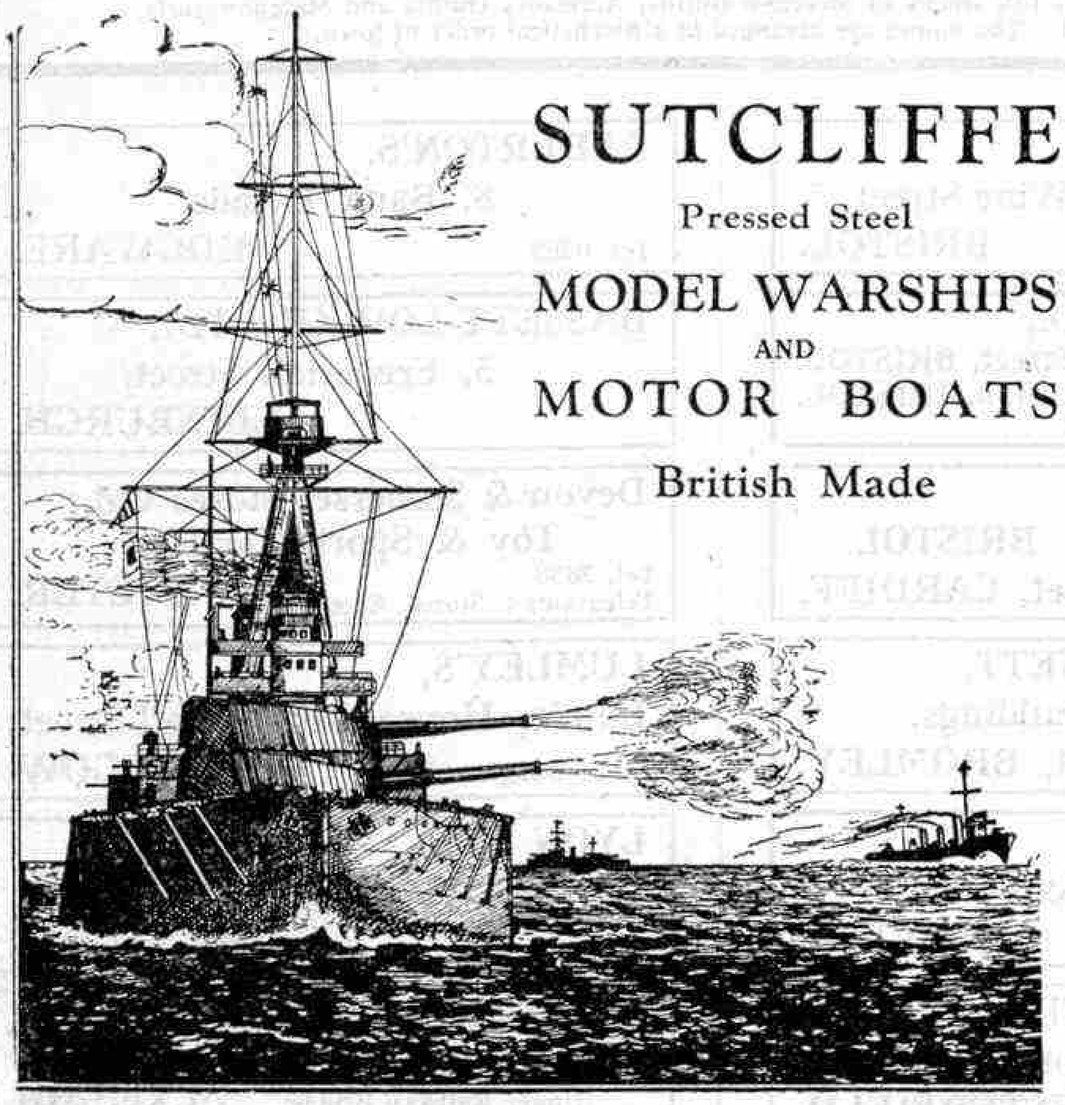
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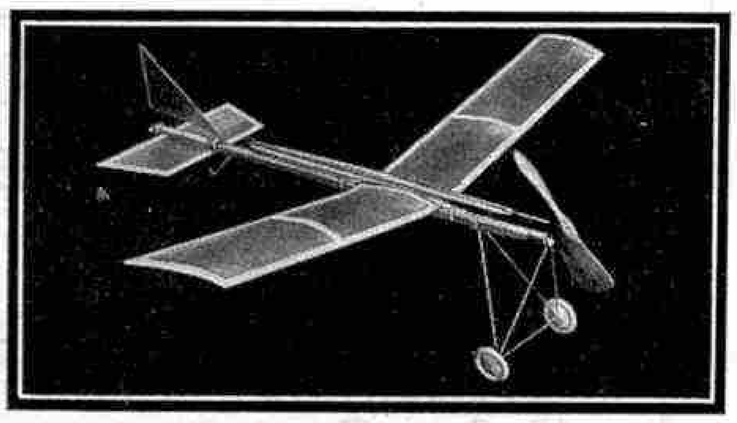
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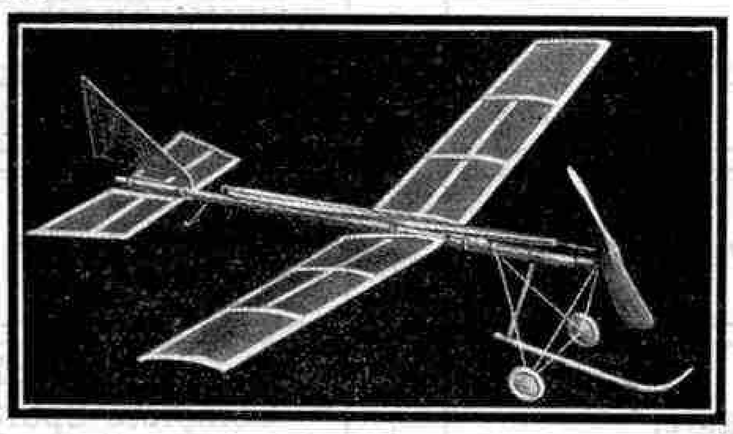
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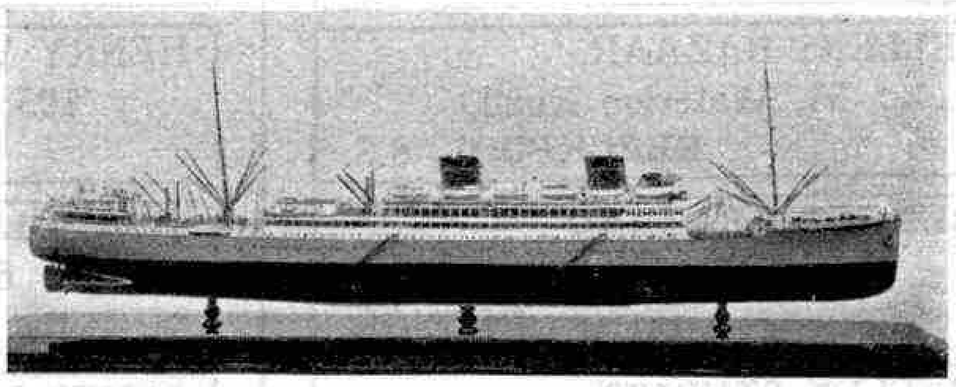
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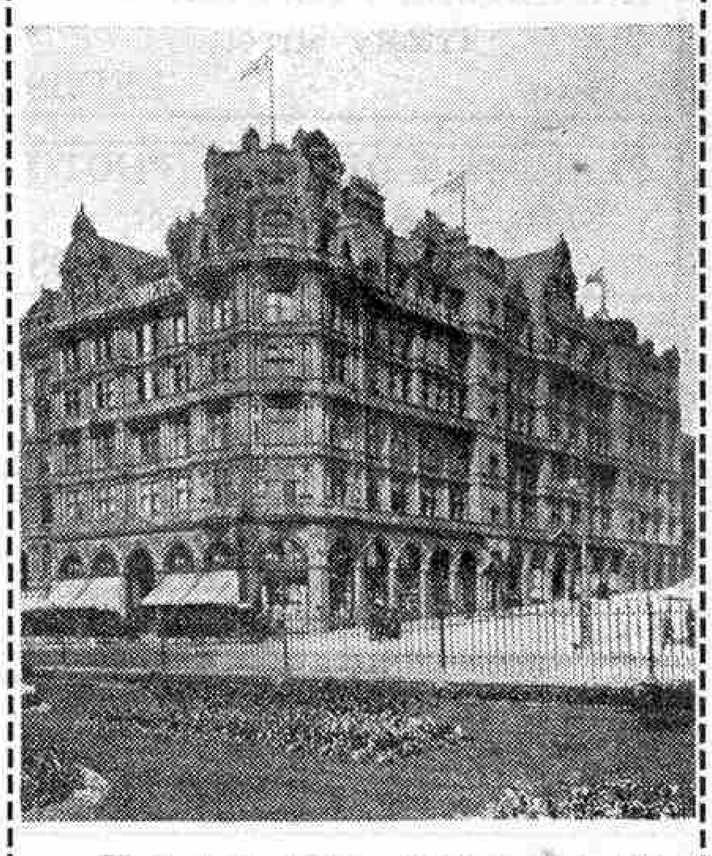
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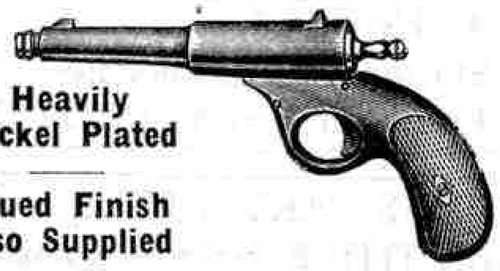
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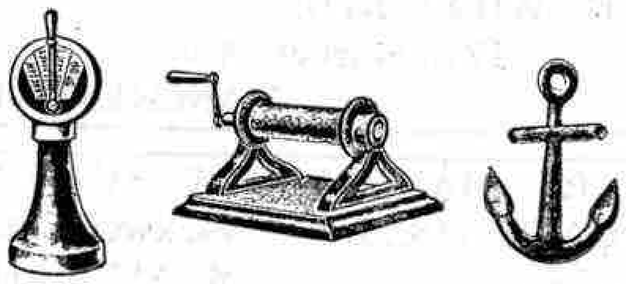
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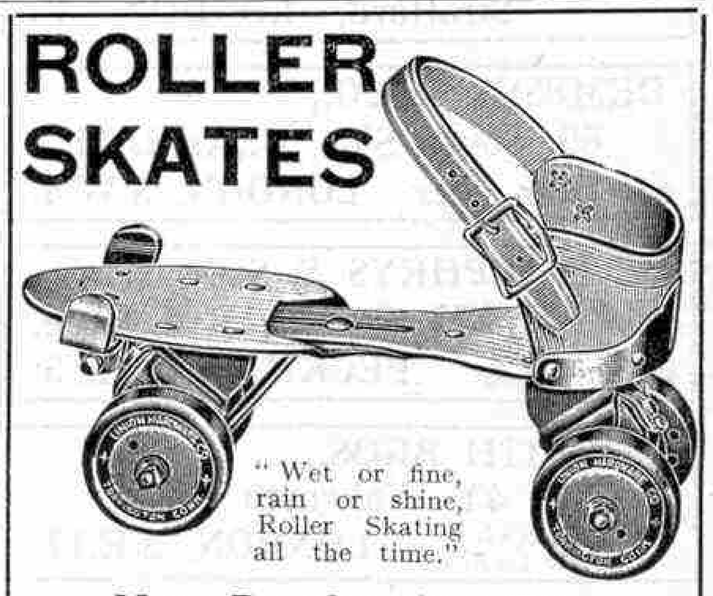
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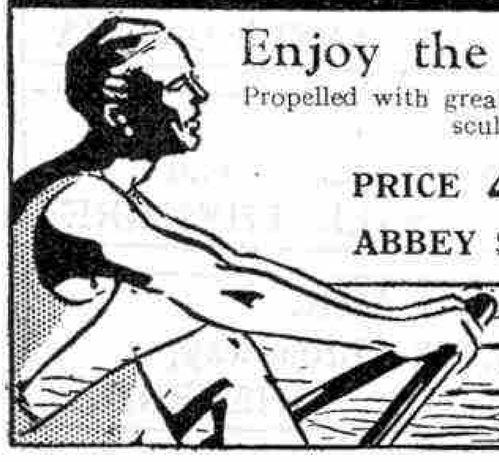
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WELL ROWED SIR! WELL ROWED! The "SINGLES-CHAMPION" 4/11



Enjoy the Thrills of Your Own Sculling Race

Propelled with great speed by powerful, long-running clockwork motor, this life-like model sculler will give you endless fun. The skiff is 19½ in. long.

PRICE **4/11** or 5/6 post free. Overseas 7/-.

Now turn to our advert on page 672.

ABBEY SPORTS CO. LTD. (Dept. M.C.), **125, Borough High St., S.E.1.**



The 1929 Jaeger Meccano Jersey

JAEGER
Pure Wool

The 1929 Jaeger Meccano Jerseys

Boys who love Meccano delight in these charming knitted garments. They are smart little outfits which can be had in a variety of colours. The neat dice effect being in a variety of colours.

Jersey BJ105

7/- for 22 in. chest, rising 9d. per 2 in. size to 30 in.

Knitted Suit No. 852

13/- for 20 in. chest, rising 1/- per 2 in. size to 26 in.

¾ Hose, Turnover Tops to match from 2/9 for size 3 to 3/9 for size 10.

Colours :

Navy with Royal Blue and Saxe border.
Drab with Brown and Saxe border.
Mixed Grey with Red and Saxe border.
Fawn with Navy and Saxe border.
Mixed Brown with Brown and Orange border.
Saxe with Navy and Light Saxe border.

Obtainable only from Jaeger Branches and Agents.
(*Write for the address of your Local Agent*).

HEAD RETAIL BRANCH : 352/54, OXFORD ST., LONDON, W.1.
WHOLESALE & SHIPPING : 95, MILTON ST., LONDON, E.C.2.

AUSTRALIA—Melbourne, 234/236, Flinders Lane, Sydney, 38/44, York Street.
CANADA—Montreal, 1187 Bleury Street.



Every man, woman, boy or girl must and should have a tube of—

SECCOTINE

The World's Great Adhesive. **Registered Trade Mark.**

Children know its value. Some time ago we heard of

a boy, who, having his attention called to the beauty and long-standing of King's College Chapel at Cambridge, hazarded the opinion that it had been put together with Seccotine. We have heard, recently, too, of

a small girl, who thought the old nursery rhyme of "Sing a Song of Sixpence" might be improved by bringing Seccotine into it. It will be remembered that

The maid was in the garden, putting out the clothes,
When by came a blackbird and snapp'd off her nose.

The child, disliking this unhappy ending, supplied the lines which follow:

The King sent through the country
To find his wisest men,
They bought a tube of Seccotine,
And stuck it on again.

The Grown-ups have discovered endless novel uses for Seccotine. Of course, the great use of Seccotine is the making or mending of articles of wood, but the world is continually discovering and becoming enthusiastic over services which it is found Seccotine will unexpectedly render.

Seccotine is on sale all the world over, from China to Peru, in shops that are numberless.

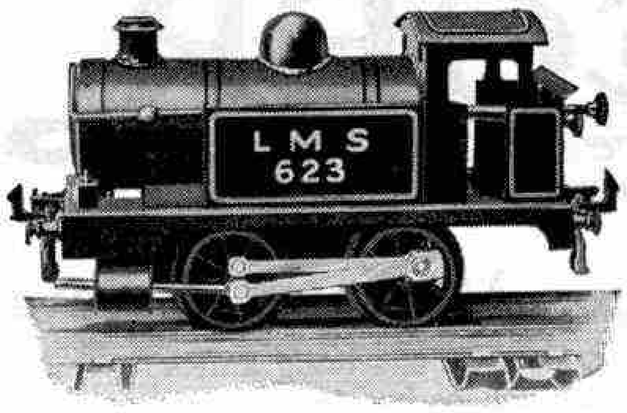
PRICE 4½d., 6d. and 9d. PER TUBE

Bulk packages are supplied for manufacturing purposes.

Interesting booklet, free on application to:

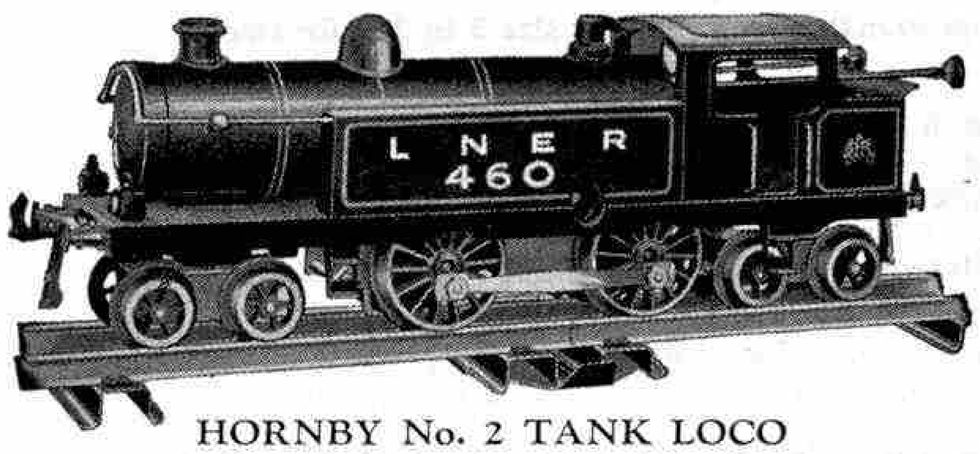
McCAW, STEVENSON & ORR LIMITED
The Linenhall Works BELFAST

HORNBY TANK LOCOS



HORNBY No. 1 TANK LOCO

Strong and durable loco capable of any amount of hard work; richly enamelled and highly finished; fitted with reversing gear, brake and governor.
Gauge 0, in colours to represent L.M.S., L.N.E., G.W. or Southern Railway Companies' Locos ... ... Price **12/6**



HORNBY No. 2 TANK LOCO

Powerful model embodying all the splendid Hornby characteristics. It is 10½" in length and is fitted at both ends with a four-wheeled bogey. Beautifully finished in colours to represent L.M.S., L.N.E., G.W. or Southern Railway Companies' Locos. Fitted with reversing gear, brake and governor. Suitable for 2-ft. radius rails only ... ... Price **22/6**

MECCANO LTD., OLD SWAN, LIVERPOOL

HAVE A BIVOUAC TENT FOR THE SUMMER HOLIDAYS



Each Tent is complete with light pegs, cord lines with metal runners, jointed poles, double head lines, all complete and packed in a bag.

No. 1. As illustrated. Size 6 ft. 6 in. long, 5 ft. 6 in. wide, 4 ft. high. In White Tent Cloth **21/6**
In Green Willesden, Proofed **27/6**
Prices of larger Tents on application.

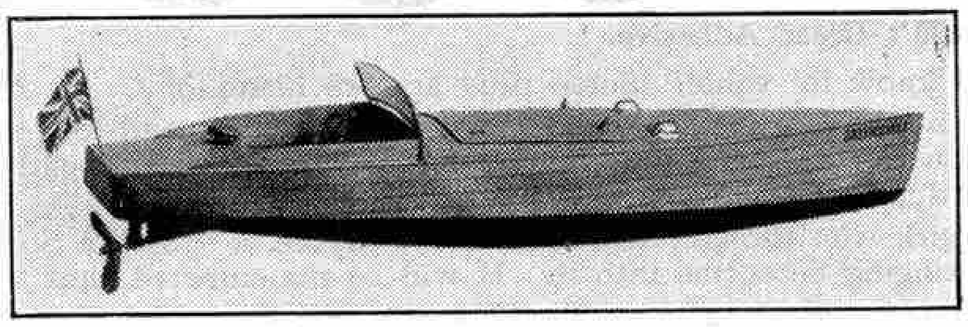
Model of MAJOR SEGRAVE'S 'GOLDEN ARROW' Motor Car
Holder of the World's Speed Record.
A Clockwork Model. Very realistic and correct in detail. 21 in. overall. **8/11** each
We can deliver at once.

REGATTA SAILING YACHTS.
Each one guaranteed to sail. **6/11, 9/11, 12/9, 16/9, 23/-**

WARNEFORD AEROPLANES.
Guaranteed to fly. Tractor type. **4/6, 7/6, 10/6, 21/-**
All above sent Carriage Paid in Great Britain.

W. HARRIS BRADLEY
Meccano Specialist and Sports Outfitter
Victoria St. and Skinner St., Wolverhampton

The "GREYHOUND" Fleet
OF
MODEL RACING MOTOR BOATS



"Greyhound" V, 21in. **17'6**
Powerful Clockwork, Fast and Long Distance

"Greyhound" III, 25in. **25'6**
Electric 1 Speed

"Greyhound" IV, 25in. **22'6**
Powerful Clockwork, Fast and Long Distance

"Greyhound" I, 25in. **35'-**
Electric 2 Speed

Stream Lined, Mahogany, Unbreakable Spray Screens, Highly Finished
The Brass Propellers are specially designed for speed. Each Boat Guaranteed

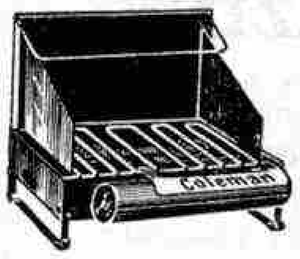
If unable to obtain from Local Dealer, write—

A. J. HOLLADAY & CO. LIMITED
3, ALDERMANBURY AVENUE, LONDON, E.C.2

"GIVJOY" Trade Mark TOYS

The GYPSY Camp Stove

A COLEMAN PRODUCT





This Camp Stove is not a toy but a miniature kitchen range. Uses petrol fuel under safety control, and is absolutely safe and foolproof. Cooking space 16½″ by 9″. Folds up like a suitcase to 17″ by 4″ by 9″. Weight 11½ lbs., 2 burners which can be used separately or together.

Price 39/6

Extract from a recent Testimonial—

"We had a call from a customer to-day to whom we recently sold one of your Camp Stoves. He did all the cooking for 16 scouts in Camp, and the boys used it themselves without supervision."

Price 39/6. Carriage and Packing Free. Ask for fully illustrated catalogue of Coleman Products.

SUNSHINE RADIATOR CO. LTD.
67, Tithebarn Street, Liverpool

Boys! If you are keen on Cars read the Motor

Of all bookstalls and newsagents.

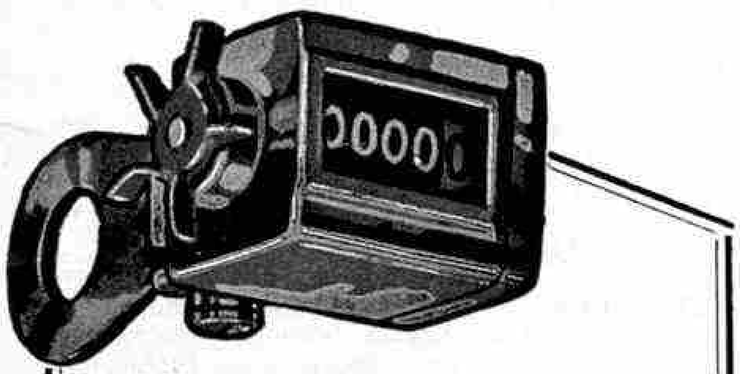
All about the latest developments and happenings in motoring—full of interest from cover to cover.

TUESDAYS 4d.

AIRCRAFT APPRENTICES

600 Vacancies are now available for boys of good education (between 15 and 17 years of age on January 1st, 1930), for training as skilled craftsmen. Good training, pay and prospects. Examination at local centres. Full particulars from Royal Air Force (Aircraft Apprentices' Dept. M.E.), Gwydyr House, Whitehall, London, S.W.1.

For all interested in Railways. "The Railway Enthusiast." (Journal of The Railway Observation Society.) Pub. 1st August, 6d. post free from The Secretary, A. E. P. McAinsh, 7, Tankerville Rd., London, S.W.16.



"VEEDER" Cyclometers

Cycling without a **VEEDER** is like living without a Watch. You cannot do one or the other intelligently.

A VEEDER tells you :—
How far you have been.
Distance from one place to another.
Service your tyres give you.
Number of miles to destination.
Total season's travel, etc.

INSIST UPON A GENUINE VEEDER
(See the name thereon).

Obtainable from all important Cycle Dealers.
Made in two Models : Regular 6/6, Trip 15/–
Send for Illustrated Booklet to :—

F. E. DICKINSON,
St. Andrew's House, Holborn Circus, London, E.C.1.

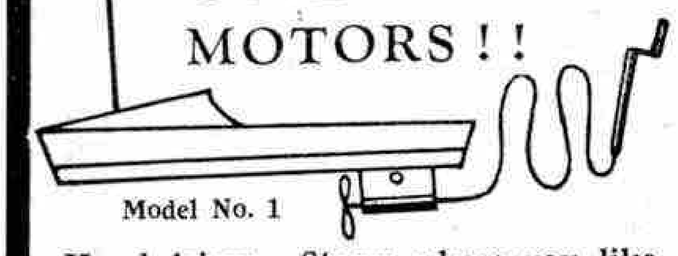


There is news in advertising.
Pass this page round the family circle.

EASTANGLE

PATENT

OUTBOARD MOTORS ! !



Model No. 1

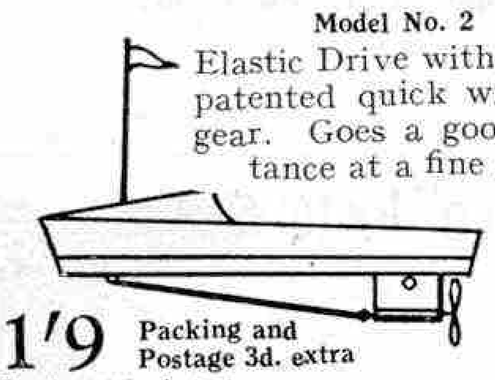
Hand-driven—Steers where you like

Complete with six feet of Flexible Shaft **2/9** **Packing and Postage 3d. extra**

Boat not included.

Model No. 2

Elastic Drive with prov. patented quick winding gear. Goes a good distance at a fine speed.



1/9 **Packing and Postage 3d. extra**

Boat not included.

Either model fixed in one minute by screw-eye provided. Can be fitted to any model boat or piece of wood.

MAKE YOUR OWN BOAT FOR THEM

The Eastangle Paravane Attachment

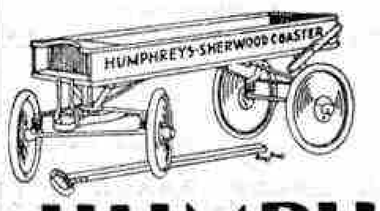
Fixed to any wooden boat by one nail. Makes boat sheer away from shore like a kite. Price, post free, **1/2.**

The East Anglian Inventions Co.
Pantiles, Pakefield, LOWESTOFT

YOUR FAVOURITE SNAP MOUNTED ON POCKET MIRROR !

Latest and most useful novelty. Send a print taken with any camera (or automatic machine). I promptly return it, mounted and encased on reverse of well-made oval pocket mirror. Photo is protected by special transparent material, greatly enhancing its attractiveness. Price 1/– each, 3 for **2/9**. All Post Free. (Money refunded if not delighted). Write now to :—
R. WHITE, 14, Cursitor Street, London, E.C.4.

WILL CARRY A TON



42/6 CARRIAGE PAID

HUMPHREYS

Sherwood Coaster

The boys will enjoy this sturdily-built general utility pole-cart, useful alike for play or for work in the garden. 10 in. disc wheels, roller bearings, 1 in. rubber tyres, coil spring shock absorbers; body measures 34 in. × 14 in. × 3½ in. deep.

Write for particulars :

HUMPHREYS Meccano and Hornby Train Depot,
Next Grove Arcade,
WALLASEY VILLAGE, CHESHIRE

FUN FOR THE HOLIDAYS!

13/6
(POST FREE)



"REGATTA" RACING YACHTS

This Yacht is 30″ high with an 18″ Deck and carries four white sewn sails which can be readily adjusted, like a real Yacht. There is a **Lead Keel** which makes for steady sailing. Mast and Rigging are removable for carrying. The Yacht is beautifully enamelled and lined in attractive colours; it is guaranteed to sail.

SEND for Fine Coloured Catalogue illustrating our series of Model Yachts

PANTOYS LIMITED
7, Promenade : Cheltenham
and 37, Westgate St., Gloucester

NATURE STUDY

Obtain your supplies of Books, Collecting Apparatus and Specimens from

WATKINS & DONCASTER, Dept. M.,
36, Strand, London, W.C.2. (P.O. Box 126).
'Phone: Gerrard 9451. Full Catalogue Post Free.

Patents for Inventions, Trade Marks : Advice Handbooks & Cons. free.—B. T. King, Regd. Patent Agent, 146a, Qn. Victoria St., London, E.C.4. 43 years' refs.



MAKE your own GRAMOPHONE at a ¼ the price. Buy only Mechanical Set as shown, namely : British double spring motor, 12″ velvet turntable. "S" neck tonearm, latest metal Soundbox, shaped internal horn, or cast throat, and needle cups for **£1/18/6,** post free in U.K. Machines sold by other firms at **£10-£20,** do not contain better fittings than these. We also sell cabinets for this set. Portable Gramophones from **20/–.** Postage 1/6. Mechanical Sets **18/–.** Motors, **8/6.** Accessories, Accordeons Violins. Lists Free. 64 pp. 1929 Catalogue, **How to make Gramophones, 3d.** Established 25 years. Thousands of Testimonials. **Regent Fittings Co., 78D, 120, Old St., London, E.C.1.**

No. 815. Tubular 2-wing horn 17/– post paid



A REAL PRINTING OUTFIT



Post Free.

AGENTS WANTED.
ORDER TO-DAY.

Thousands of satisfied customers throughout the U.K.

SOPHUS BERENDSEN (London) LTD.
10, PHILPOT LANE, LONDON, E.C.3

READERS' SALES

For Sale. Clockwork Boat. As new. Cost 21/–, take 15/6. Used three times.—A. Pedley, 2, Balfour Crescent, Wolverhampton.

Sale. Mould for Lead Soldiers. Used once, 4/6.—Storrar, Letham, Fife.

"Meccano Magazines," 1926-28, 8 missing, 3/–.—87, Foulden Road, Stoke Newington, N.16.

Sale. Clean Cigarette Cards and Albums, "Meccano Magazines."—14, Lansdown Parade, Cheltenham.

For Sale. Boiler and Horizontal Steam Engine, one-third horse power. Write for particulars.—BM/KMVD, London, W.C.1.

Ensign Box. Year old. Good condition. Offers. Cost 12/6.—R. H. Reeves, Malting Lane, Much Hadham, Herts.

Sale. M.M. 1928 and to June, 1929. Good condition. Offers. Hill, "Bissington," King's Road, High Barnet, Herts.

Sale. Fifteen rare Coins, £18/10/–.—Moshug, 160, Lower Circular Road, Calcutta.

Railway Postcards, 1½d. each.—Gauld, 1, Thackeray Street, Liverpool.

Stamps. Exchange Stamps with British Colonies.—Phillips Rance, 311, Rosewell Avenue, Toronto 12, Ontario, Canada.

For Sale. No. 0 Brownie, "Meccano Magazines," 1924-1929, Basuelle, Skittles. Offers—Daniell, Hursley Hill, Whitchurch, Bristol.

Sale. "M.M.'s" 1926-27-28. Complete. "Modern Boy," first number to present date. Cash offers.—Eric Sargeant, Lympstone, Devon.

Wireless. Spares for Sale. Send Stamp for List.—Harland, 72, Longwest Gate, Scarborough.

Collection of 1,186 different Stamps in Strand Album. Cat. over £8. Price 25/–.—Michael Cox, Methven Castle, Methven, Perthshire.

Sale. Horizontal Steam Engine. Offers above 55/–. Cost 95/–. "0" Gauge Railway Accessories. Stamp for Lists and Particulars.—Penoyne, Chipping-Warden, Banbury, Oxon.

Cheap. New Cinematograph and Films. Cost 12/6. "M.M.'s" 1926, 1927 and 1928; yearly sets. Offers?—BM/ZHLB, London, W.C.1.

New 22/6 Bassett-Lowke Horizontal Boiler, 15/–. ¾" Stroke Engine, unused, 3/6. "M.M.'s" 1928, good condition, 3/–. All £1.—25, Muller Av., Bishopston, Bristol.

Cigarette Cards. Sets, Odds, Lots. Lists—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Wanted. Autographs of Sportsmen. Photo Postcards specially desired.—Ridley, Clitheroe St., Preston.

Cheap. Parts to build Wormar Steam Engine, Model E. Offers.—Jeavons, 70, Wingrove Road, Newcastle-on-Tyne.

For Sale. July-December, 1927, half-volume, in good quality cloth boards, price 8/6. Box 801.

WRITING PADS
FOR MECCANO BOYS



These Writing Pads are becoming increasingly popular and most of the letters we receive from Meccano boys are written on the familiar tinted paper. The pads are supplied in two sizes, each consisting of 50 sheets of tinted bank paper, with cover. They are just the thing to use when writing to your friends, for the special notepaper shows that you are a Meccano boy.

Prices—Large, 1/– each (post free); Small, 6d. each (post free).

Meccano Ltd., Binns Road, Old Swan, Liverpool

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RAILWAY PHOTOGRAPHS
Sixth List Now Ready

Collectors of long standing tell us that our photographs are the finest ever produced. They cost 3d. each, or 2/6 a dozen. Send 4d. for specimen card and latest list M6.
Railway Photographs, 23, Hanover St., Liverpool.

"Remanco" Pistol



The Perfect Pea Repeating Pistol. Fine heavy black model. Patent breech feed. Fires 20 peas with one loading. Long range accuracy guaranteed. Ammunition supplied. Colonial postage 9d. extra. **2/- (post free)**
"WILD WEST" PEA PISTOL, 1/– post free.
NORWOODS (Dept. M), 16, Cullum St., London, E.C.3.

OIL CAN No. 1 (Ordinary Type)



This miniature Oil Can will give every satisfaction. It may be used for general purposes but it is particularly suitable for oiling Meccano Models and Hornby Trains. Price 6d.
Meccano Ltd., Binns Road, Old Swan, Liverpool

THE "MONARCH" De-Luxe Large CAMERA
Regd.
Fitted with Genuine **Guaranteed Meniscus Lens, Reflex Viewfinder,** Nickel-plated **Spring Lever Shutter, Lever Guard, Real Leather Handle and absolutely Guaranteed to take Perfect Large Photos size 3½"x2½"**

SALE PRICE 1/9 ONLY! Post 3d.



Camera and all accessories! Ready to take, develop and print splendid photos! Everything complete, packed in Strong Card Box post free! Send P.O. 2/- only! Nothing further to pay!

THOUSANDS TESTIMONIALS.
W. J. Thomas, Esq., writes: "Developed and printed photo: think it as good as if taken with a Camera which cost £3."
Sale Catalogue 1,000 Big Bargains Post Free.
THE LEEDS BARGAIN - CO. (M), 31, Kendal Lane, LEEDS.

1/- ONLY or direct 1/3 post free 3 for 3/6 6 for 6/6

BANG!!! GOES THE "CLICO"
THE ABBEY POTATO PISTOL



The ingenious "Clico" moulds and fires Potatoes, Apples, etc. This wonderful long-range pistol is ABSOLUTELY HARMLESS and provides hours of Pleasure for Boys.
No Caps to Buy, No Peas to Buy. A Potato—Mother will supply.
Abbey Sports Co. Ltd. (Dept. M.C.), 125, Borough High Street, S.E.1.
Sole Concessionaires for the World.

Now see page 668.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/– per copy (postage extra), and the subscription rates 7/– for six months and 14/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post free).

The U.S.A. price is 15c. per copy, and the subscription rates 90c. and $1.75 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 45, Colborne Street, Toronto.
UNITED STATES: Meccano Co. Inc., Elizabeth Av., Elizabeth, N.J. Meccano Co. Inc., 200, Fifth Avenue, New York.
AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Bombay Sports Depot, Elphinstone Street. Bombay: Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

"MECCANO MAGAZINE" BINDERS

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines—price 4/6 post free. The small binder holds 6 Magazines—price 3/– post free. Meccano Ltd., Binns Road, Old Swan, Liverpool.

GAMAGES

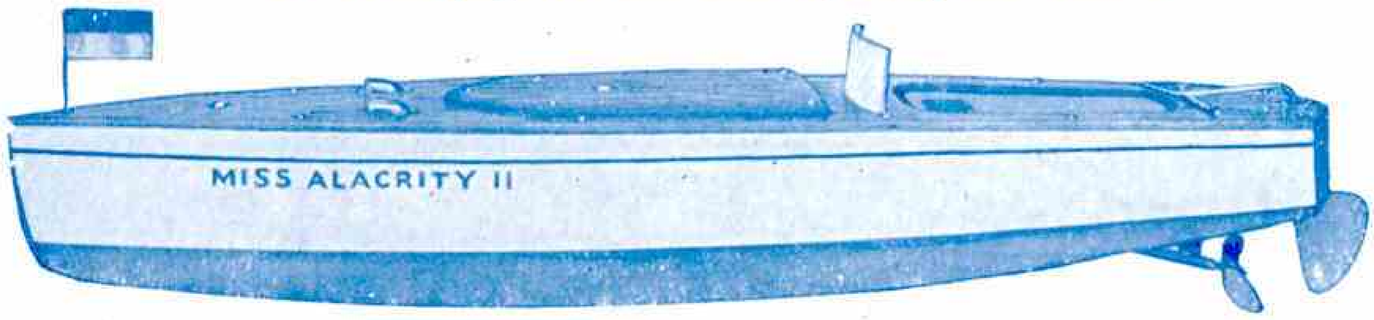
The Boys' Own Store

Month by month these announcements bring the World's Greatest Boys' Store closer to thousands of boys. The Mechanically Minded boy, the Sporty boy, the average boy—all can find many things of great interest at Gamages. This month our page contains some especially fine models.

FOOTBALL!

Write for Copy of Gamages Famous Football Catalogue. The Best Guide to all Football Requirements.

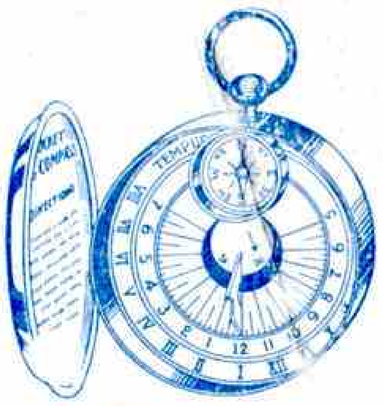
Write for a Copy of Gamages Latest Toy and Model Lists



A NEW MODEL SPEED BOAT

Fitted with extra strong clockwork motor. Will run a long distance at high speed. Hull highly finished in two Colours. Made in two sizes.

No. 1 **15/-** No. 2 **22/6**



A Combined POCKET SUNDIAL AND COMPASS

Mounted in Oxydized Metal Case for the pocket, Ivorine Back for making Notes. Specially made for the use of Boy Scouts and Camping Parties. Post 3d. **3/9**



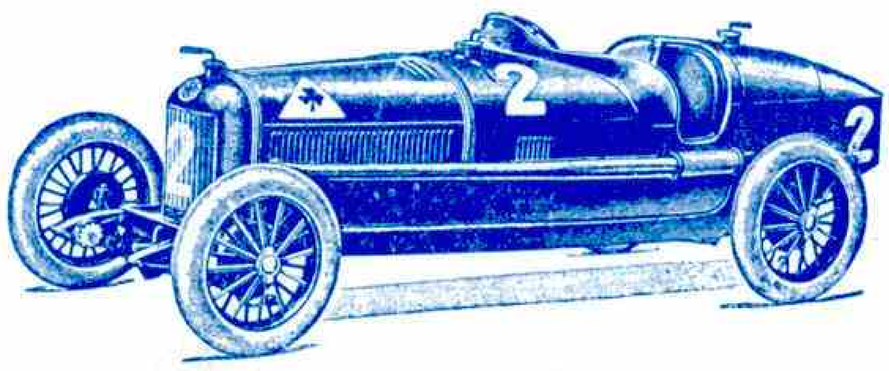
Boy's Three Draw Telescope

Made in Polished Brass. Specially suitable for Boys on Country Rambles, etc.

3/6

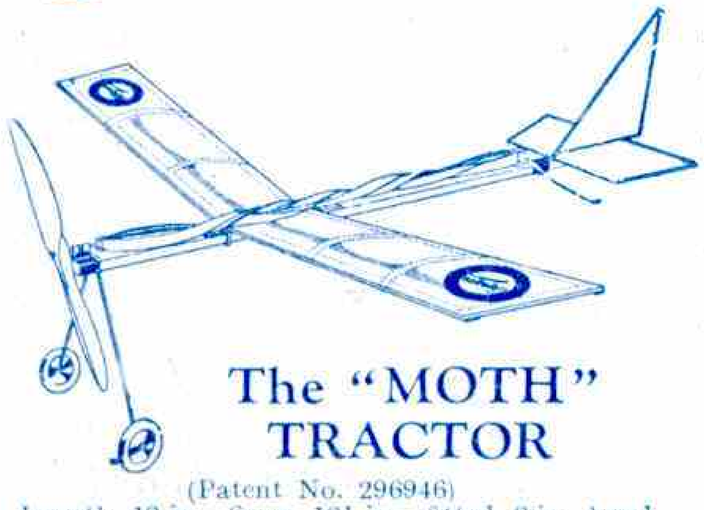
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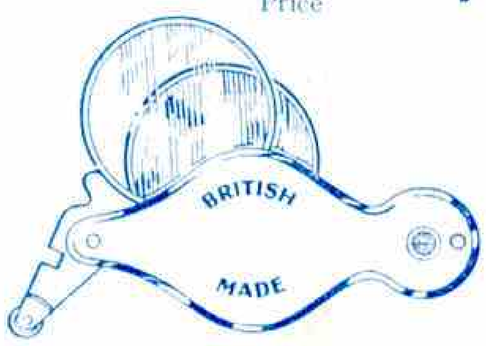
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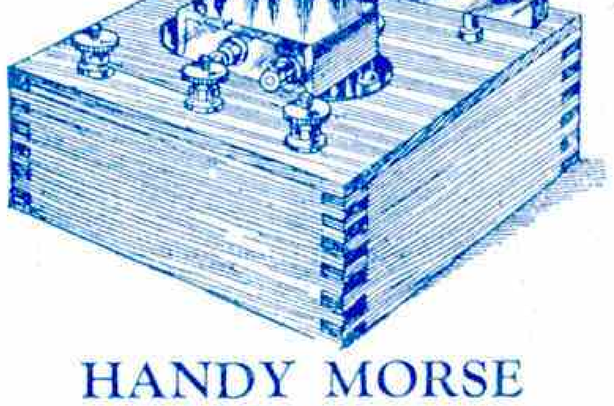
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(Patent No. 296946)

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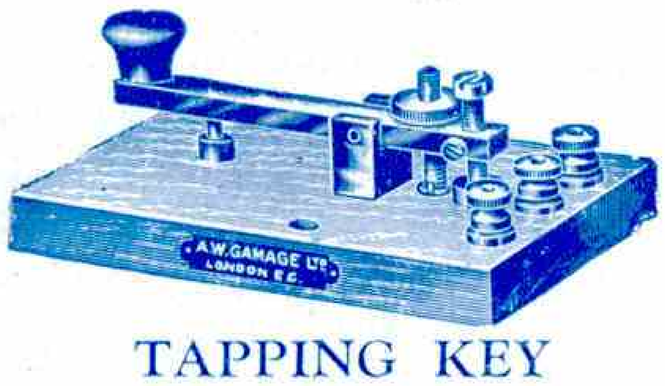
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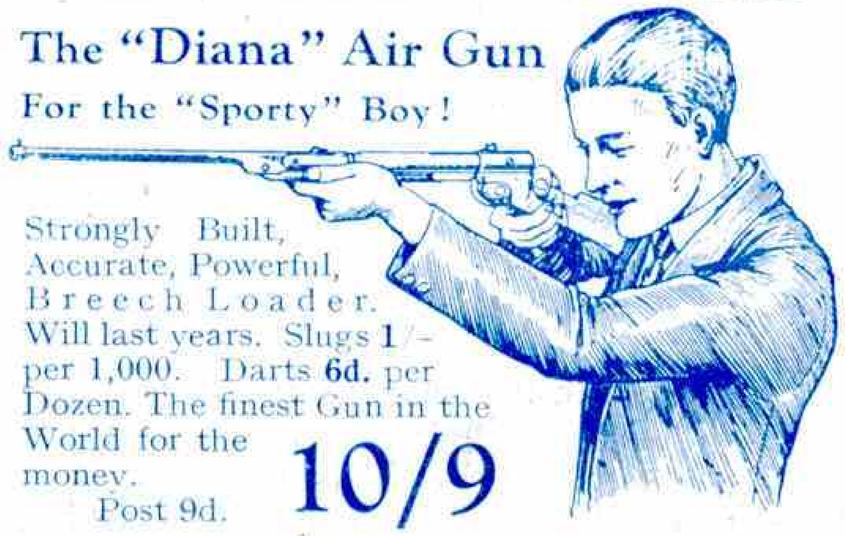
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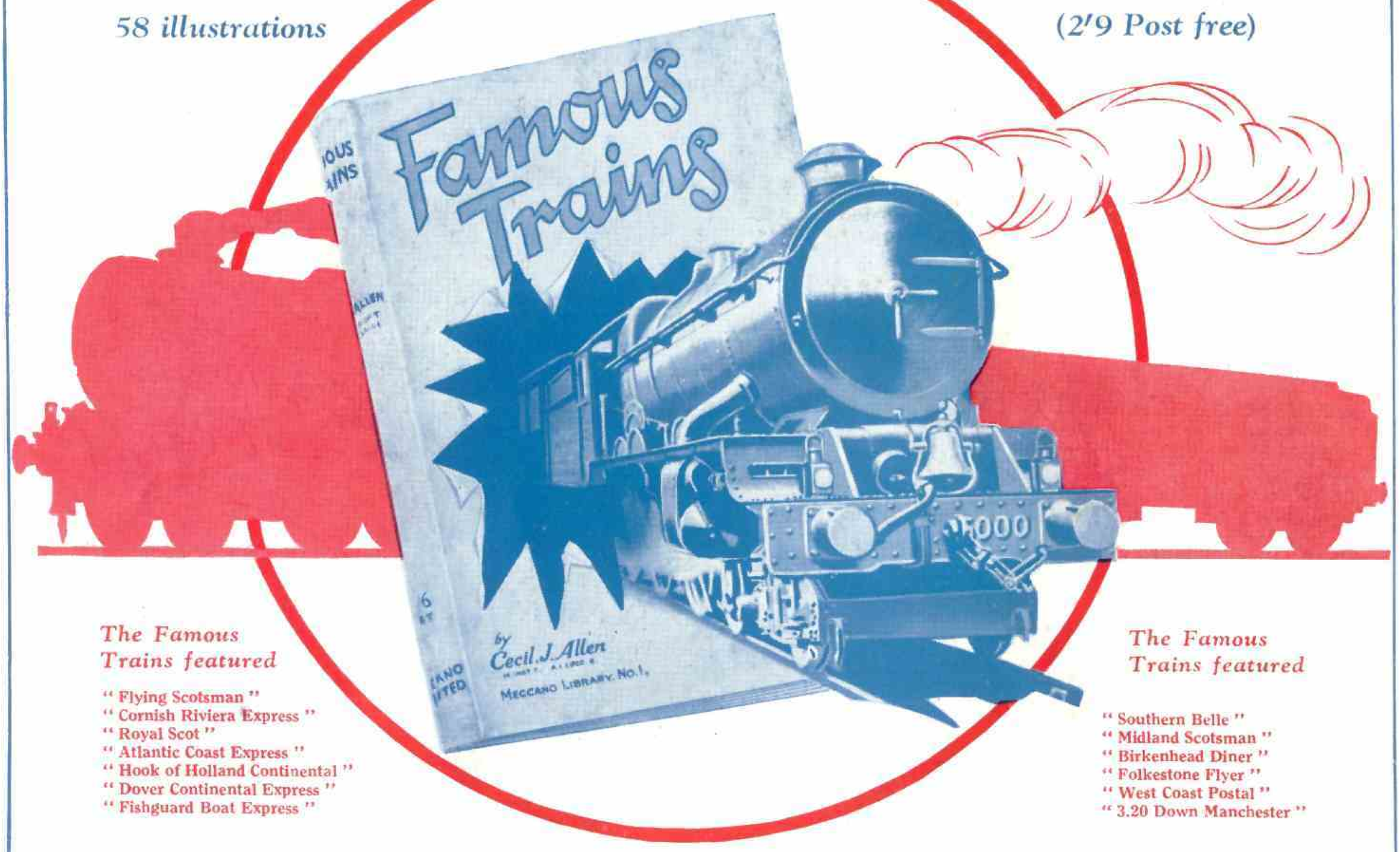
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